Payload Communication Workbook

P/L COM 2102

Advanced Training Series
For Training Purposes Only

Training Division
Training Integration Branch

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PAYLOAD COMMUNICATIONS WORKBOOK

THIS BOOK IS A PRELIMINARY COPY. THE FINAL VERSION WILL BE AVAILABLE IN ~~AUG 83~~ MARCH 84.

ANY QUESTIONS CAN BE ADDRESSED TO:

JERRY MAPP DG3 x3601

FOREWORD

DEVELOPER JERRY WAYNE MAPP

BRANCH Flight Training

MAIL CODE DG4

TELEPHONE 483-3601

LOCATION BLDG 4 /ROOM 2039

This training material is part of a series of lectures, handouts, and workbooks for instruction on Orbiter Systems.

This training package should be studied before attending any classroom session on this material or taking any lesson for which this is a prerequisite.

The Orbiter Systems lesson sequence chart shows where this lesson fits in the series, the prerequisites for each lesson, and the optimum presentation order. The lesson sequence charts are located in the Shuttle Training Program catalog.

This material is for training purposes only; it should not be used as a source of operational data.

The last two pages of this workbook are two forms:

1. Lesson Critique Sheet. This is used to obtain your comments on this workbook. Please fill it out and mail to the instructor when you have completed this workbook. (It need not be placed in an envelope nor be signed.)

2. Training Report. This applies to MOD personnel ONLY. It provides the information to enter this training in your training record. To receive credit when you have completed this workbook, please complete the Training Report and mail to (DG).

HOW TO USE THIS WORKBOOK

This book is organized into sections. You should proceed through the sections in the order they are presented.

Section 1 contains a system overview and functional description. This section is designed to help a crewmember understand the workings of the system without being specific, unless it is of critical importance to the crewmember.

Section 2 is designed to familiarize the crew member with the displays and controls which may be required for use during the course of a mission.

Section 3 is designed to expose the crewmember to flight data file procedures and give an understanding of the reasoning behind each procedure.

Section 4 is designed to expose the crewmember to "off-nominal" flight data file procedures and give an understanding of the reasoning behind each procedure.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to "Warnings," "Cautions," and "Notes" found throughout this manual.

WARNING

Procedures, techniques, etc., which could result in personal injury or loss of life if not carefully followed.

CAUTION

Procedures, techniques, etc., which could result in damage to equipment if not carefully followed.

NOTE

Procedures, techniques, etc., which require emphasis.

This is your book! Make notes and write comments anywhere you like.

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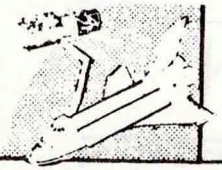

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JSC
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PL COMM SYSTEM

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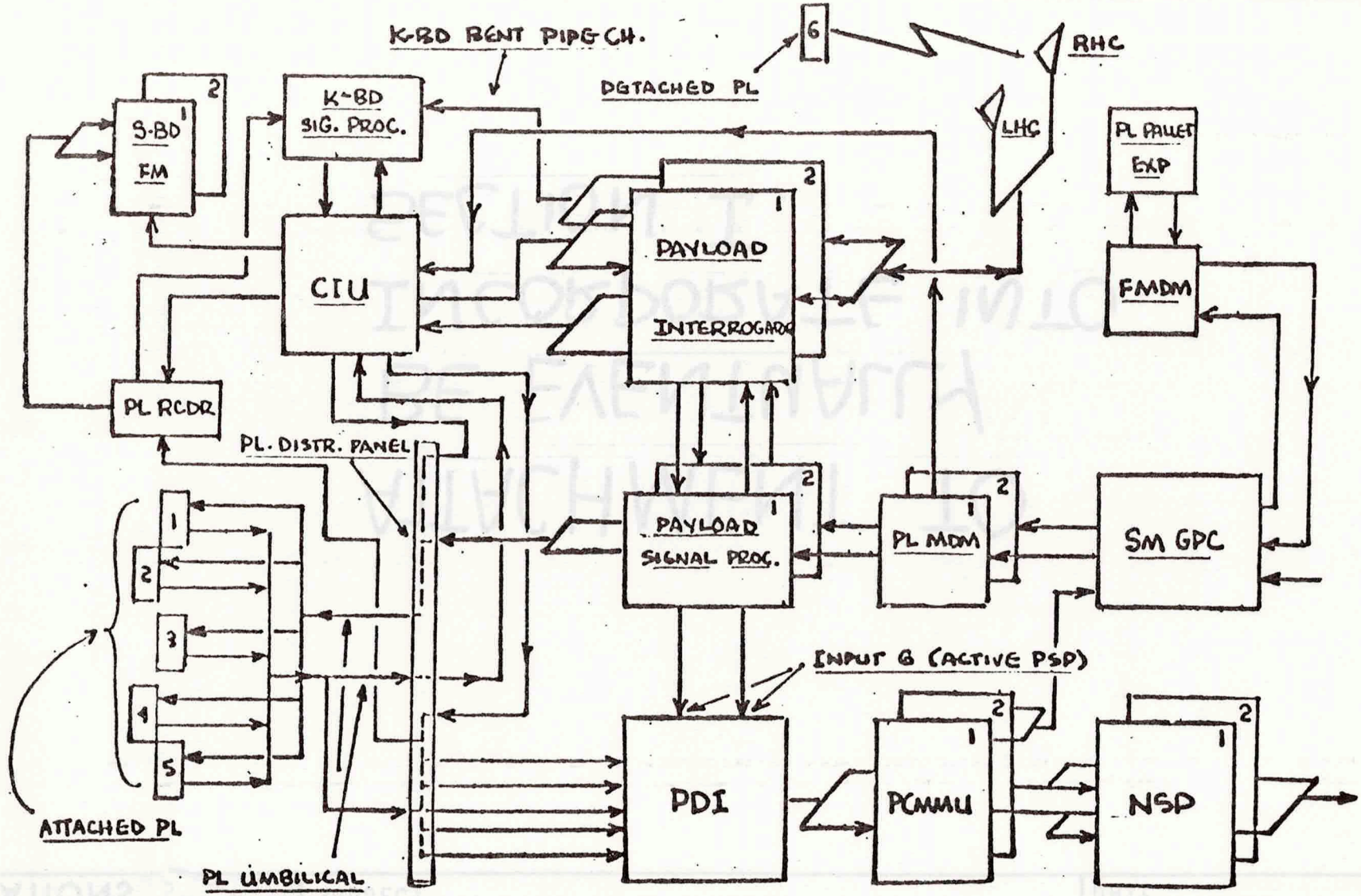

NASA/DOD LRUs

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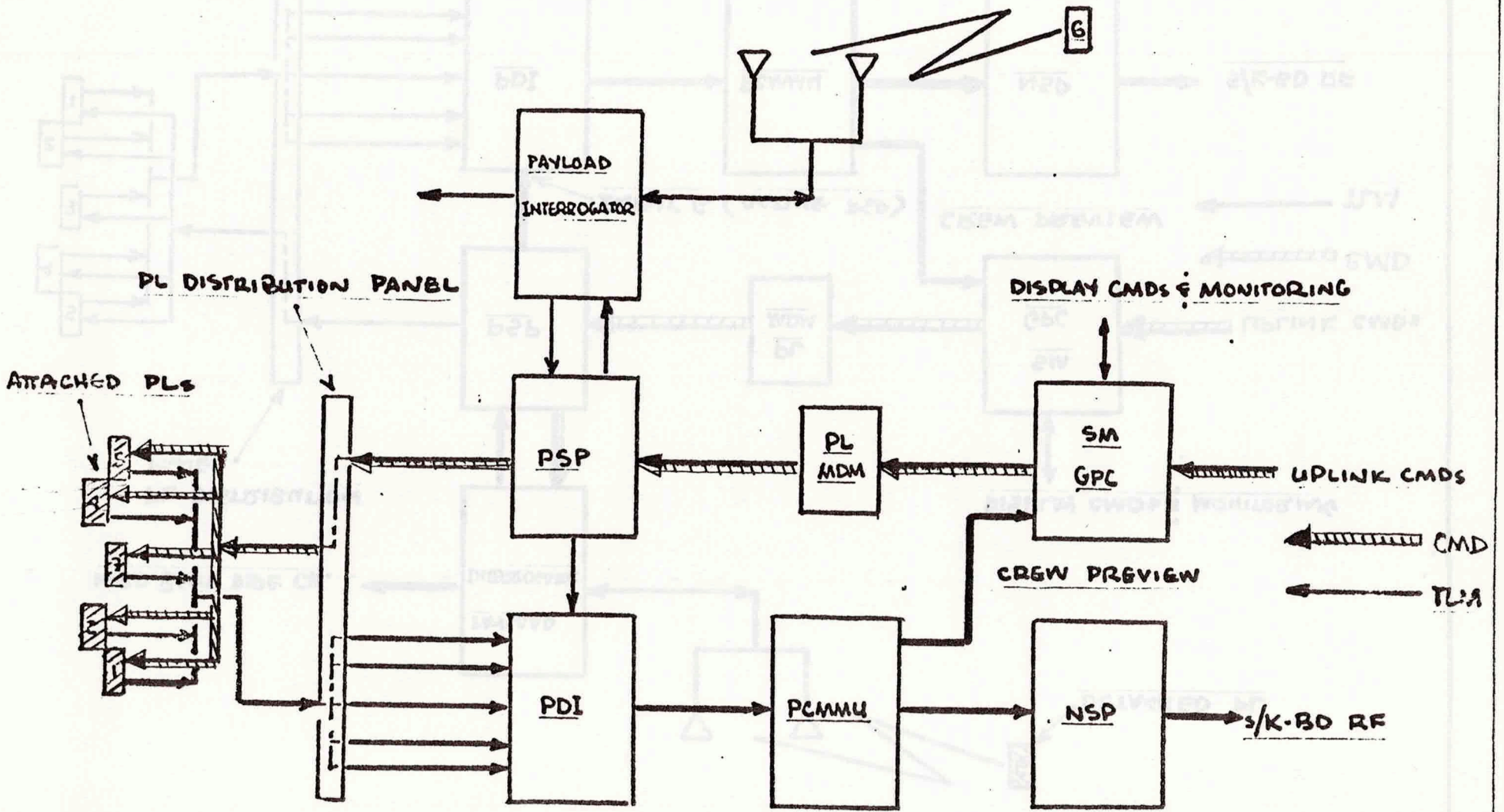

NASA HARDLINE C/ MODE

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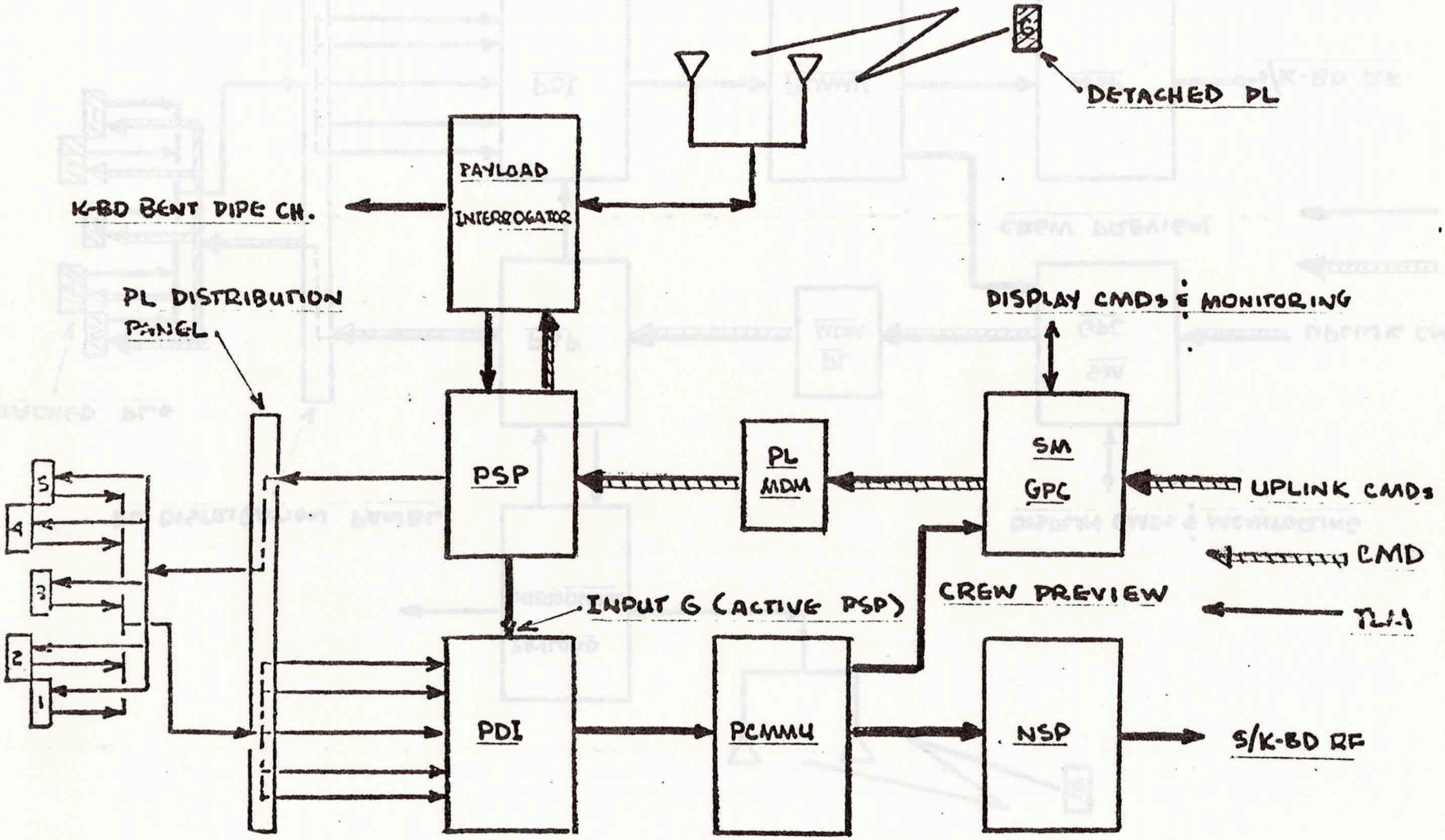

NASA RF CMD MODE

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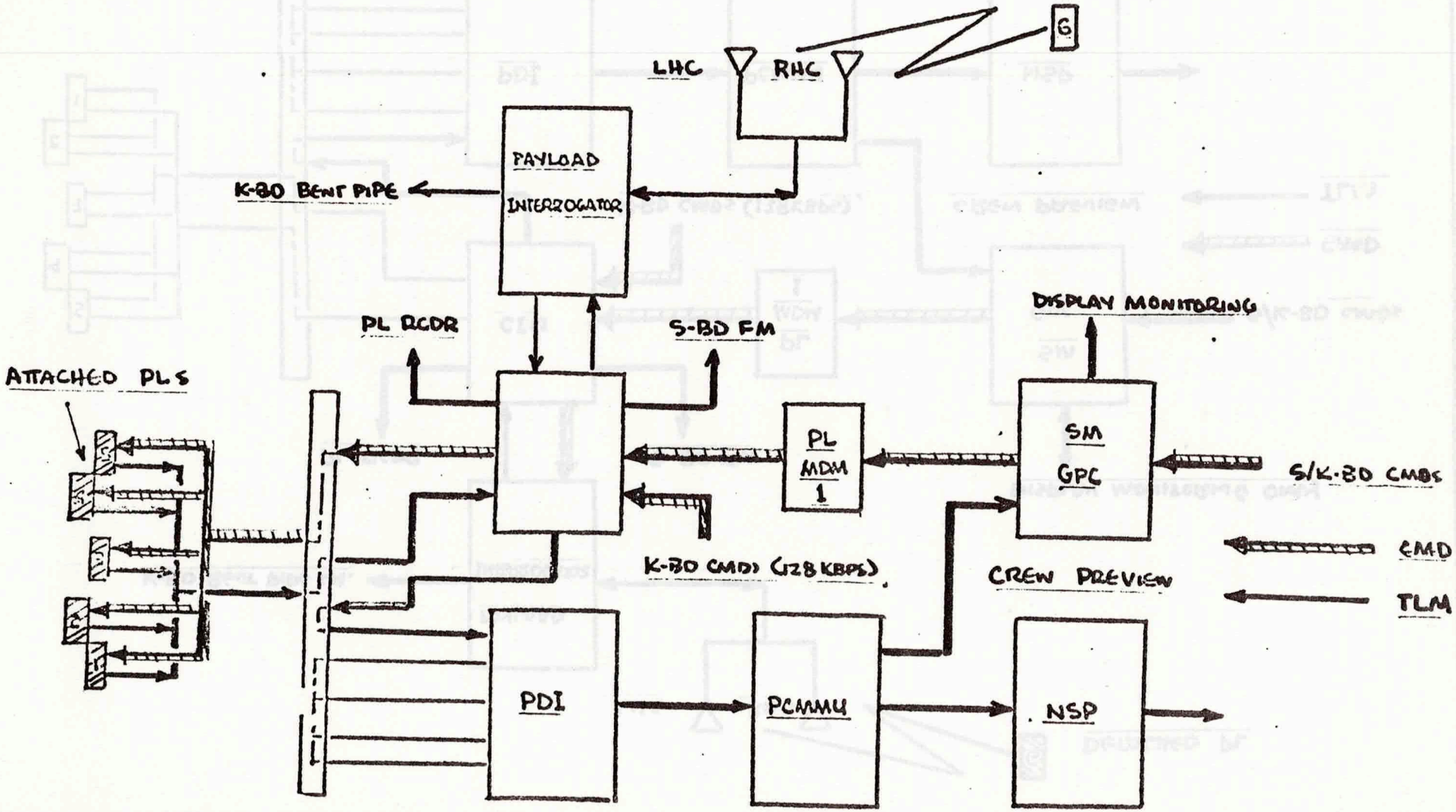

DOD HARDLINE CMD MODE

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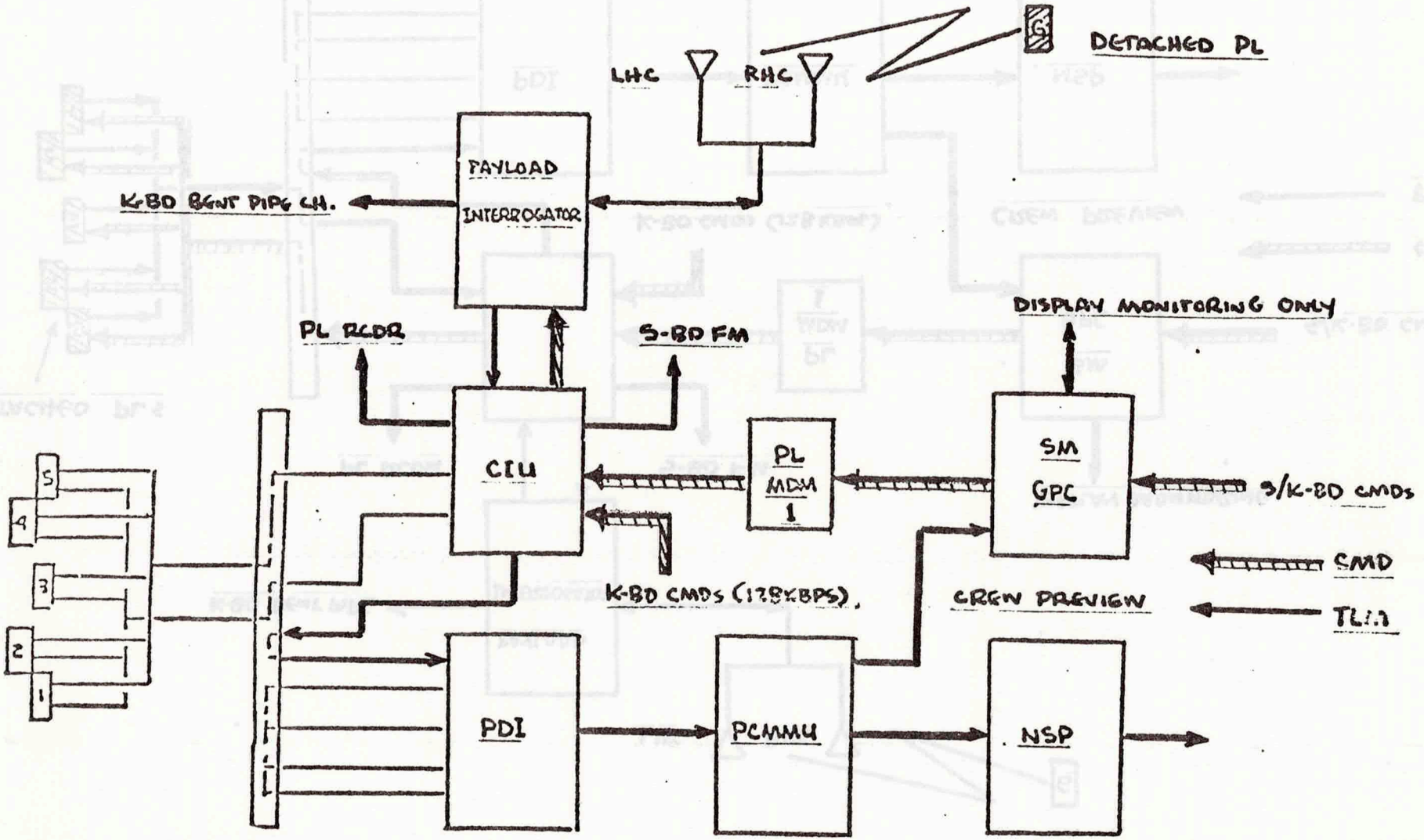

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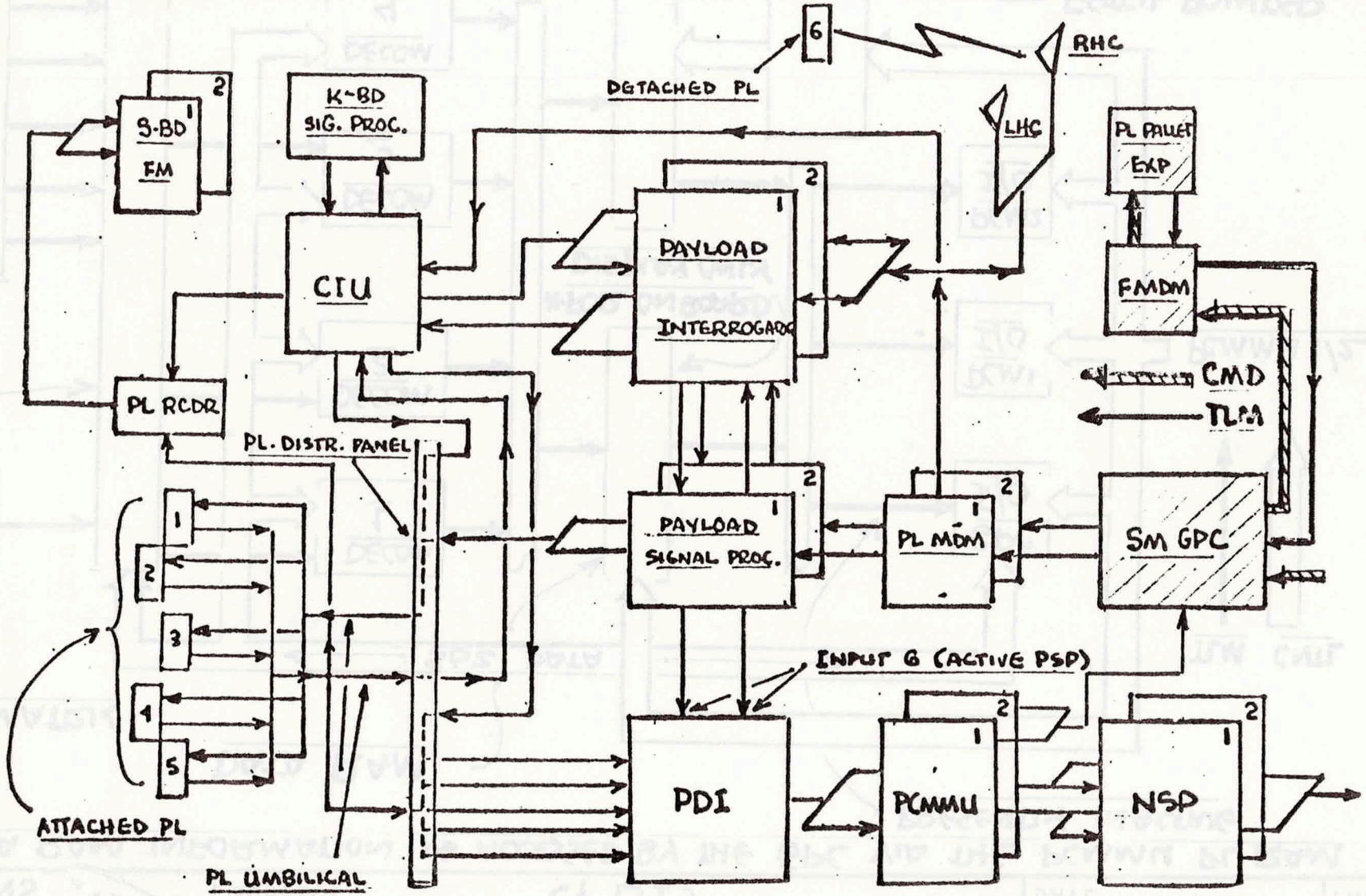

PL PALLET COMM

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PAYLOAD DATA INTERLEAVER (PDI)

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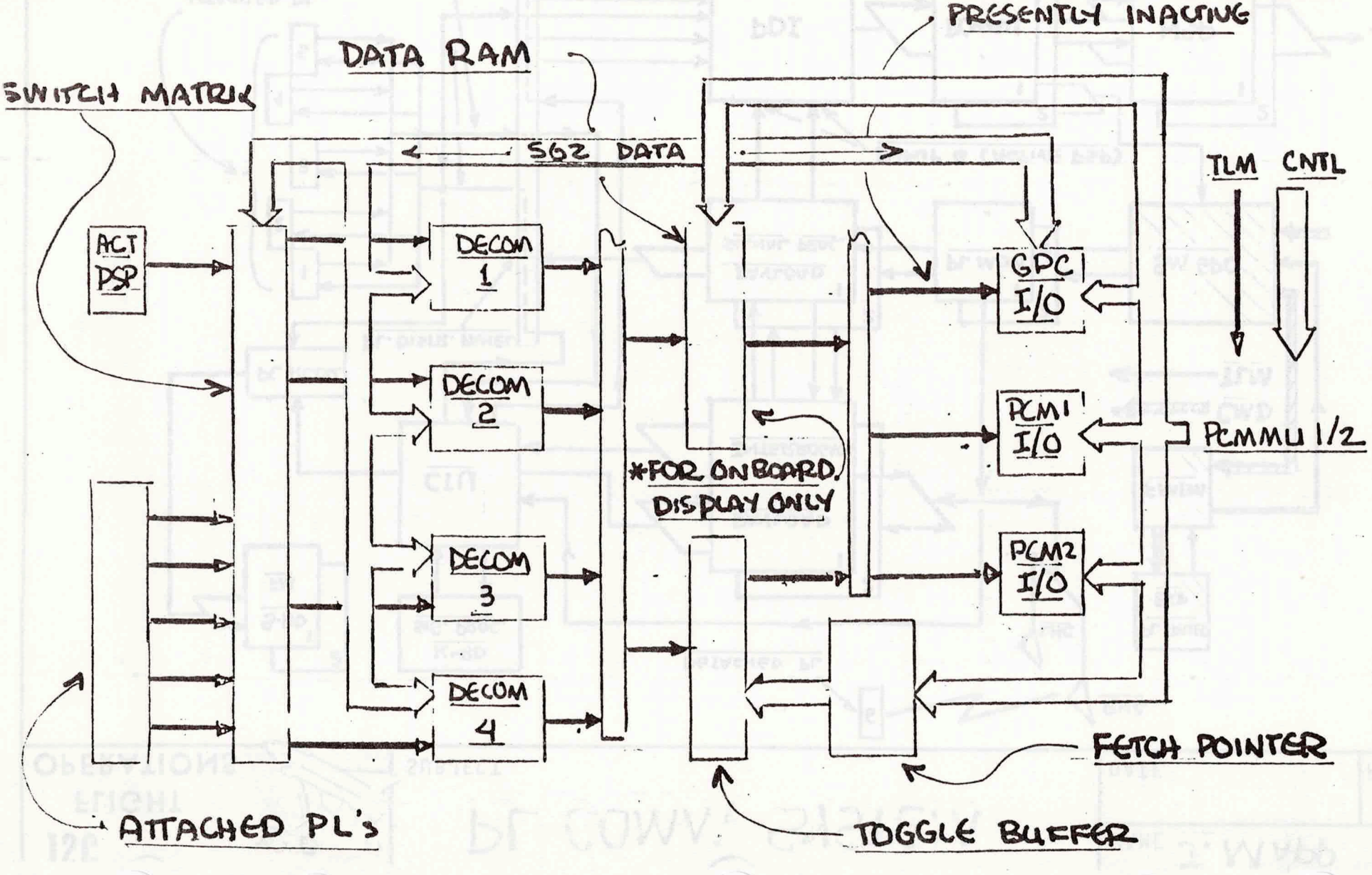
*PDI DATA RAM INFORMATION IS ACCESSED BY THE GPC VIA THE PCMMU PL RAM



PDI, PCMMU & PDI/MDM C/A ALERTS

PDI ASSOCIATED

PDI PWR FAIL → S62 BCE BYP PL
PDI PWR FAIL → S62 BCE BYP PDI

PSMR BYPASS (PDI) → S62 BYP PDI

GPC S/W OR PL BUS PROB.
PDI/GPC MIA PORT OR PDI LOGIC FAIL → S62 BYP PDI

PL TO ORBITER PI RF LINK FAIL
PI RCVR FAILS
PL TLM OUTPUT TO PDI FAILS
PDI DECOM FAIL
PSP FAIL
PSP 1(2) TO PDI DATA PATH FAIL
→ S62 PDI DECOM FAIL

PCMMU ASSOCIATED

PDI OUTPUT LOGIC FAIL
PCMMU MIA OR PDI PORT FAIL
(PDI/PCMMU DATA PATH FAIL)
→ S62 BYP PL

DATA PATH PCMMU/GPC
SM BCE XMTR/RCVR
PCMMU MIA XMTR/RCVR
PCMMU 1(2) FAIL
ALL PCMMU READ ELEMENTS FAIL
→ I/O ERROR PCM (CM)

PSP ASSOCIATED

PL TLM SYS FAIL
PSP OR PL OUTPUT FAIL
PI PROB OR LOSS OF PL TLM LOCK
→ PSP BIT AND/OR FRAME SYNC FAIL

PSP DATA PATH FAILS
PSP PWR FAILS
PSP LOGIC LOCKUP ON PSP TO PLMDM DATA PATH
→ S62 BCE BYP PSP 1(2)

MDM ASSOCIATED

OF1 OR OF2 MDM FAIL
MDM/PCMMU PATH FAIL
PCMMU MDM PORT FAIL
→ S62 BCE BYP OFA (VIA PCMMU)

0F3 OR 0F4 " " } S62 BCE BYP 0FB (VIA PCMMU)

0A1 OR 0A2 " " } S62 BCE BYP 0A (VIA PCMMU)

IOP BCE XMTR FAIL
PCMMU FAIL } I/O ERR D/L

SECTION 1

INTRODUCTION

1.1 PURPOSE

The Orbiter Payload Communication System (PL COMM system) is designed for both hardline and RF communication with a wide variety of payloads. It is used to activate and checkout both attached and detached payloads and is used for safing prior to payload recovery.

The PL COMM System can support payload commands and status through onboard controls and display. The system can also provide support for ground commands and telemetry through the S or K-Band Systems. (See figure 1-1.)

TBS

Figure 1-1. Payload Communication System Operations Concept

The two largest user agencies of the Shuttle as a payload launcher are NASA and the DOD. Other users will be satellite consortiums, such as COMSAT, private industry, and foreign countries. The design of the Payload Communication System has been driven predominately by the two largest users, NASA and DOD; consequently, standard capabilities have evolved to meet primarily the needs of these two users. Non-standard conditions have been provided for, but generally have less operational capability.

All standard commands and telemetry signals are processed on-board the Orbiter. Non-standard signals which cannot be processed are handled by the Orbiter in a high bit rate "bent-pipe" mode of operation.

The following are the basic elements integral in payload communication:

- Payload Interrogator (PI)/Antenna
- Payload Signal Processor (PSP)
- Communication Interface Unit (CIU)
- Payload Data Interleaver (PDI)
- Pulse Code Modulation Master Unit (PLMMU)
- Payload Recorder (PL RCDR)
- Payload Multiplexer Demultiplexer (PL MDM 1 & 2)
- Flexible Multiplexer Demultiplexer (FMDM)

These elements are located in the forward avionics bay 1 and 2. (See figure 1-2.)

TBS

Figure 1-2. Payload Communications System Line Replaceable Unit Location

1.2 PAYLOAD INTERROGATOR/ANTENNA

The Payload Interrogator (PI) is a transmitter/receiver used to establish full duplex RF communications between the Orbiter and a detachable payload. It transmits commands to and receives telemetry from both NASA and DOD payloads via a circularly polarized antenna. (See figure 1-3.)

The circularly polarized antenna permits attitude independent payload communication. Antenna polarity is selected by switch or Ground Command Interface Logic (GCIL) commands and is nominally configured to match the polarity of the payload's antenna. Effecting RF communications with a distant payload require that the payload be within the 80^{o} beam width (referenced around -Z) of the Orbiter's PI antenna. This constraint is normally satisfied by the payload deploy/retrieval processes.

The PI operates in one of two modes, NASA or DOD. The NASA mode provides RF interface with Spaceflight Tracking and Data Network (STDN) and Space Ground Link System (SGLS) compatible payload, while the DOD mode provides SGLS payload compatibility. The PI sends data to and receives commands from the PSP mode and the CIU when in a DOD mode. The mode is established by selection of an appropriate transmit/receive frequency pair and a signal processor interface (NASA or DOD). The frequency pairs are selected by channel numbered thumbwheels or GCIL commands.

TBS

Upper Fuselage - FWD

Figure 1-3. Antenna Element Location on Vehicle (Upper Fuselage)

The DOD signal processor interface is activated by a Commands Interface Unit (CIU) discrete; otherwise, the Payload Signal Processor (PSP) interface is active. The PI transmitter has both modulation and transmit frequency sweep controls. The modulation control is used during acquisition to prevent a payload's receiver from false-locking to the PI's transmitted signal. By turning the modulation off during acquisition, false-lock is prevented. The transmit frequency sweep control is used to accommodate payloads with a fixed receiver frequency. A payload receiver with a fixed frequency will not sweep (Auto Tune) for the PI's signal. So, the PI transmit frequency sweep may have to be enabled to allow the payload's receiver to lock-on. Since a payload's signal strength is inversely related to the distance, the PI has controls for varying its transmittor output. The PI receiver automatically sweeps, acquires, locks-on, and phase-tracks an unmodulated or modulated RF signal. Phase lock TLM is available to indicate signal presence and tracking.

In addition to the PSP/CIU interfaces, the PI can interface directly with the K-Band signal processor via a dedicated channel operating in parallel, but independent of the NASA and DOD channels. The bent-pipe mode is used to accommodate payloads which have non-standard formats.

1.3 PAYLOAD SIGNAL PROCESSOR

The PSP provides for command support of five attached or detached payload sources, rate-buffered output of commands to payloads, and a detached payload telemetry interface to the Payload Data Interleaver (PDI). The PSP provides two primary functions:

1. Receives telemetry data in RF form from a detached payload (via the PI). The PSP will receive a subcarrier modulated signal at 1,2,4,8, or 16 kbps. After the signal is received, the PSP will demodulate it, provide bit and frame synchronization word lengths, and then transmit the corrected frame synchronization pattern, NRZ payload telemetry data, and clock timing signals to a buffer where it will be stored until requested by the PDI. The PDI provides output data rates of 1, 2, 4, 8, or 16 kbps. The PSP is also capable of transmitting a serial PSP status message upon request to the GPC via the payload MDM plus a bit sync lock and frame sync lock discrete status signal to the Operational Instrumentation (OI) Multiplexer/Demultiplexer (MDM).

2. Receives configuration and payload command messages from the GPC via the payload MDM at the burst rate of 1 Mbps. A configuration message will always precede the payload command message. After the PSP receives the command message, it will convert it from a digital signal to an RF signal, provide timing, and then send it either to the PI or to five attached payloads. The signal is in the form of a 16 kHz sinewave subcarrier to the PI or a 16 kHz modulated signal to attached payloads.

The PSP configuration (proper command and telemetry rates) is controlled by crew inputs (prestored) via the Multifunction CRT Display System (MCDS) and the SM

software or ground uplink messages. No Backup Flight System (BFS) software support is provided.

Under nominal conditions, the PSP power is provided via main bus B power.

The PSP is thermally cooled by water loop coldplates in the forward avionics bay.

1.4 COMMUNICATION INTERFACE UNIT

The CIU primary function is to provide command and telemetry data conditioning between the STS Shuttle Orbiter and a DOD Transponder. The CIU provides COMSEC for DOD command data. Figure 1-4 illustrates Shuttle payload signal processing utilizing the CIU. The CIU provides command conditioning for data from the Orbiter K-Band system, MDM, and Guidance, Navigation and Control (GN&C) MDM, as well as, crew generated data from the control panel. Input command data is validated, formatted, modulated on a SGLS baseband carrier, and forwarded directly over hardline to the PL Transponder in the attached mode or through the PI on an RF link in the detached mode. In a similar manner, PL telemetry is received over hardline (attached) and from the PI (detached). Telemetry frame data is received as Phase Shift Keyed (PSK) modulated subcarrier, frequency multiplexed with FM/FM environmental data. Detected telemetry data is conditioned and supplied to the FM Signal Processor, PDI, K-Band System, and the Payload Recorder (PL RCDR). Figure 1-5 shows a simplified block diagram for the CIU. Microprocessor technology is fundamental to CIU operation. The microprocessor provides command formatting, telemetry frame synchronization, VCC extraction (required for DOD commands), command authentication, CIU mode control, and status display. In addition, a microprocessor is utilized to implement the bit synchronization function. The CIU consists physically of four boxes and two control panels mounted in an Orbiter standard console. The four boxes consist of two Government Furnished Equipment (GFE) units (KGT-60 and KGR-60), a CIU BLACK unit, and a CIU RED unit.

1.5 PAYLOAD DATA INTERLEAVER

The Payload Data Interleaver (PDI) provides PCMMU and GPC access of up to seven asynchronous payload PCM bit streams. It provides input channels for both attached and detached payloads and can select and process in parallel any four input channels for inclusion into the Orbiter downlink telemetry stream and for SM GPC software acquisition. The PDI can be divided into six functional elements; the Switch Matrix, Decommutator Assemblies, Data RAM, Toggle Buffer, Fetch Pointer Memory/Toggle-Buffer Indicator (FPM/TBI), and Input/Output Data Bus (I/O DB). (See figure 1-6.)

1.5.1 Switch Matrix. The switch matrix is a programmable device that routes data from any of seven input channels to any of four DECOM assemblies. Any input channel can be routed to one or more DECOM assemblies. Five of the six inputs are from the payload patch panel normally used by attached payloads. Input six is dedicated to the active PSP (1022) for RF telemetry acquisition. The Input/DECOM interfaces are activated during the PDI format load procedure. The switch matrix is cyclically interrogated by the GPC for its configuration.

TBD

Figure 1-4.

TBS

Figure 1-5. Communication Interface Unit Block Diagram

TBS

Figure 1-6. Payload Data Interleaver

1.5.2 Decommutator Assemblies. The four decommutator assemblies are programmable devices that identify, select, and format that part of a payload's telemetry stream to be included in the Orbiter's downlink telemetry. A DECOM's program (Format) is loaded from mass memory through the SM common buffer by the LOAD PDI DECOM FORMAT procedure. At present, the SM GPC does not cyclically interrogate the DECOM assemblies for their format (program #); they are only updated during the load process. Each DECOM sync status is monitored by the SM GPC's fault detection and annunciation sw. This aids in the detection of problems anywhere along a payload's telemetry stream. Each decommutator outputs its data to a toggle buffer and/or a Data RAM as determined by the DECOM's format program.

1.5.3 Data RAM. The Data Random Access Memory (RAM) provides the Orbiter's GPC S/W access to individual payload measurements. Payload data being throughput to the ground via the PCMMU downlink telemetry stream is implemented by the PDI's toggle buffer under control of the FPM/TBI.

1.5.4 Input/Output Data Bus. The Input/Output Data Bus is used by the GPC's, PCMMU 1 and PCMMU 2 for read and write access. The input data bus allows the SM GPC to download DECOM/FPM format programs and to select switch matrix inputs. It can also be used to write to the PDI's Data RAM. The output bus is used to access data in the PDI storage elements and transfer the data from the PDI box. The major storage elements accessible via the output bus are the data RAM, the FPM, the DECOM assemblies, and the switch matrix. At present, the toggle buffer and Data RAM are accessible only by the PCMMU's. The SM GPC reads the FPM/DECOMS for format load verification and the switch matrix for input status.

PDI Display and control is via SPEC 062 PCMMU/PL COMM display. This display provides the capability, via the PL 1 bus, to load the PDI DECOM FPM and to select the switch matrix input sources. In addition, S62 provides a display of the current status of PDI operations and the currently loaded DECOM/FPM formats and selected input sources. The PDI power is controlled and operated by the GCIL or a power switch on panel A1L.

1.6 PCMMU

Pulse Code Modulation Master Unit (PCMMU) receives downlist format from each GPC. The PCMMU's interleave operational instrumentation data and payload data with the downlist telemetry data into telemetry data formats for transmission to the Network Signal Processors (NSP). Data parameters to be downlisted are selected preflight and organized into formats: one frame of data is transmitted to the PCMMU every 40 milliseconds.

PCMMU has a control logic section which receives the downlist data from each GPC and stores this data in a memory area (assigned to that GPC) called a toggle buffer.

Each PCMMU also has memory areas called fetch memories which tell the PCMMU control logic which payload parameters are to be loaded into the payload RAM and which instrumentation parameters are to be loaded into the instrumentation RAM.

Each PCMMU has a 128-kilobit per second (kb/s) telemetry formatter and a 64-kb/s telemetry formatter. The 128-kb/s formatter reads either a Programmable Read

Only Memory (PROM) or a programmable format RAM, to determine which toggle buffers are going to be read. The PROM and RAM also contain the information which tells this formatter how to combine the toggle buffer data with the payload and instrumentation data to form a 128-kb/s output to the NSP's. The 64-kb/s telemetry formatter uses only the first half of the data contained in the toggle buffers for combination with the payload and instrumentation data to form the 64-kb/s output to the NSP's. The 64-kb/s and 128-kb/s RAM's may be programmed on orbit with formats stored on main memory when requested via SM OPS 2 SPEC 62 keyboard entries and when the panel C3 OI PCMMU FORMAT switch is in the GPC position.

Two PCMMU's are available for redundancy, but only one PCMMU is active at a time. The power switch on panel C3 controls whether PCMMU 1 or 2 is active.

1.7 FLEXIBLE MULTIPLEXER/DEMULTIPLEXER

The principal component of the pallet data system is Flexible Multiplexer/Demultiplexer (FMDM). The FMDM will act as a data acquisition, distribution, and signal conditioning unit between payloads and the Orbiter's GPC's. As a transmitting unit, it accepts serial digital data via half-duplex data bus (PL-1), converts or formats this information into analog, discrete, or serial form, and transfers it to the payload subsystem. As a receiving unit, it accepts analog, discrete, or digital data from the payload subsystem, converts or formats that information into serial digital form, and transfers it to the Input/Output Processor (IOP) to be sent to the GPC's. The FMDM can be configured to fit the individual I/O support needs of a payload for a particular flight. The Input/Output Modules (IOM's) can be designed for a specific payload and then "plugged" into the FMDM to support that payload during the flight. Thus, the FMDM is really an inexpensive way to configure MDM's for payload support.

The principal elements of the FMDM are the Multiplexer Interface Adapter (MIA), the Sequence Control Unit (SCU), Analog-to-Digital (A/D) converter, and the IOM's. These components and their data interchanges are shown in figure 1-7. The MIA performs the function of an encoder/decoder between a data bus channel and a payload. The MIA receives serial Manchester-coded data from the data bus, formats the data into serial NRZ format, and provides necessary signals and tansmission errors for the host. In the receiving mode the MIA receives serial NRZ data from the host, formats the data into serial Manchester form, and transmits them to the data bus. From the MIA, the data are sent to the SCU. The SCU controls all operations of the MDM by executing microprograms from a 512 word control store memory within the SCU. The SCU receives the incoming command or command data word, synchronizes it to the SCU timing, and performs various tests on the incoming message. The tests include verification of proper sync, proper interword gap time, proper MDM address, and MIA error check. The A/D converter converts analog input signals received from payload subsystems into digital signals for retransmission to the GPC IOP. The A/D module consists of a converter and a multiplexer, both of which are controlled by the SCU. The A/D converter converts analog input signals in the range of +5.11 to -5.12 V dc into ten binary bits, two's complement form. There are up to eight IOM's of nine different types accessible for interface to the payload system; however, only five of these modules are defined for use in the Orbiter Flight Test (OFT) time

TBD

Figure 1-7.

frame. These modules will accept both analog and discrete signals, reformat, and transmit them to their appropriate device.

1.8 PAYLOAD RECORDER

A Payload Recorder (PL RCDDR) will be available on flights to provide for the capability to record and dump payload analog data and digital data. The recorder is able to record any one of three serial inputs: up to 14 parallel digital inputs; up to 14 analog inputs; or combinations of both analog and digital up to 14 inputs from the payload patch panel. All payload digital data has to be dumped serially. No parallel dump capability exists. The digital recorded data can range from 25.6 kbps to 1.024 Mbps with 14 selectable speeds available, although only four are available per flight. The total record time available ranges from 56 min for 1.024 Mbps to 18 hours 40 min for 25.6 kbps.

SECTION 2

DISPLAYS AND CONTROLS

The purpose of this section is to familiarize the student with the location, nomenclature, and function of the displays and controls which may be required for use during the course of a mission.

Displays are lights and speakers.

Controls are switches and circuit breakers.

2.1 OPERATIONAL INSTRUMENTATION PCMMU CONTROLS (Panel C3)

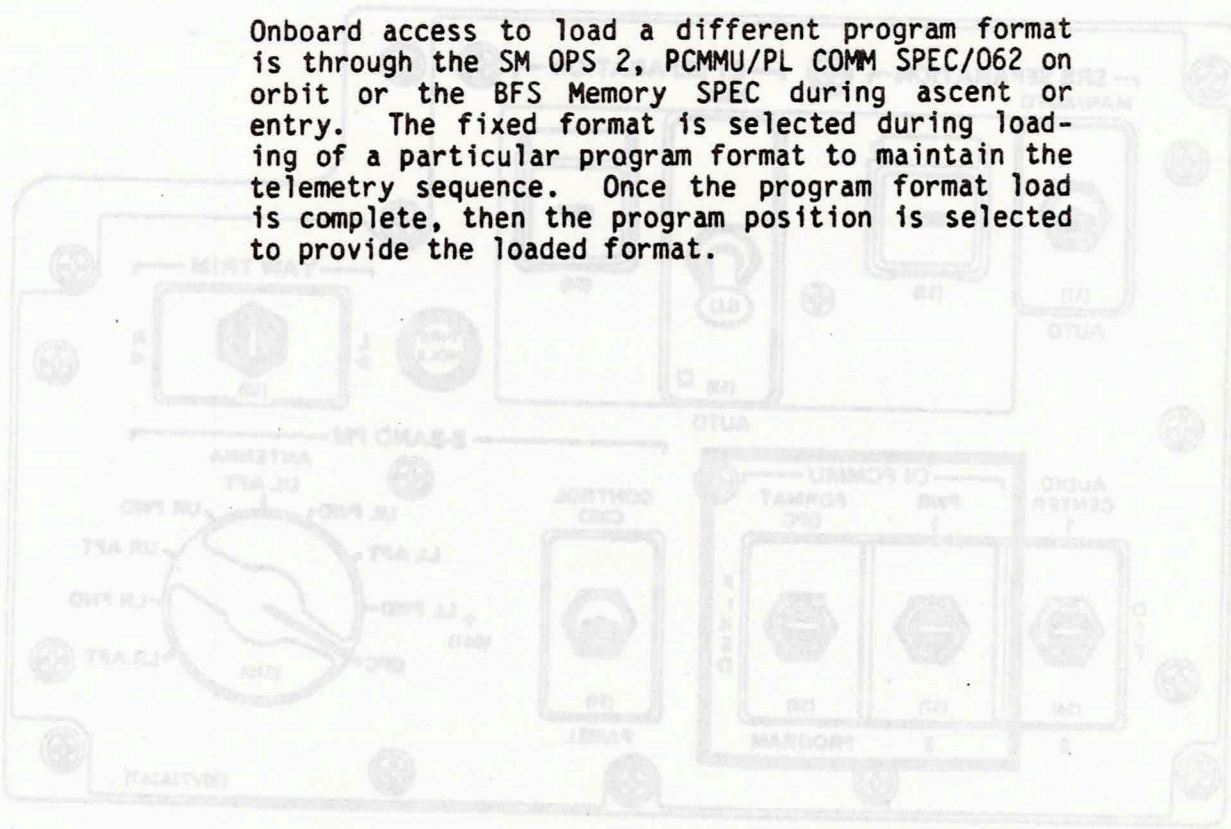
(Reference Figure 2-1.)

NOMENCLATURE		FUNCTION
OI PCMMU		Formats data from the OI MDM's, the GPC's, and the PDI into a serial digital data stream for telemetry, recording, and Ground Support Equipment (GSE).
PWR	SW	Provides PWR to the OI PCMMU 1(2) and a PCMMU 2(2) ENABLE signal to the NSP's.
		NOTE The enable signal identifies to the NSP which PCMMU will communicate with the NSP. Powering down the PCMMU erases the RAM when the OI PCMMU switch is in the OFF position.
Format	SW	Allows General Purpose Computer (GPC) or manual selection of a fixed or programmed format.
GPC		Allows the ground via uplink or the crew through the keyboard to select a fixed or programmed format.
FIXED		Selects an HDR format as defined by the PROM.
PROGRAM		Selects an High Data Rate/Low Data Rate (HDR/LDR) format as defined by RAM.

NOMENCLATURE	FUNCTION

NOTE

Onboard access to load a different program format is through the SM OPS 2, PCMMU/PL COMM SPEC/062 on orbit or the BFS Memory SPEC during ascent or entry. The fixed format is selected during loading of a particular program format to maintain the telemetry sequence. Once the program format load is complete, then the program position is selected to provide the loaded format.



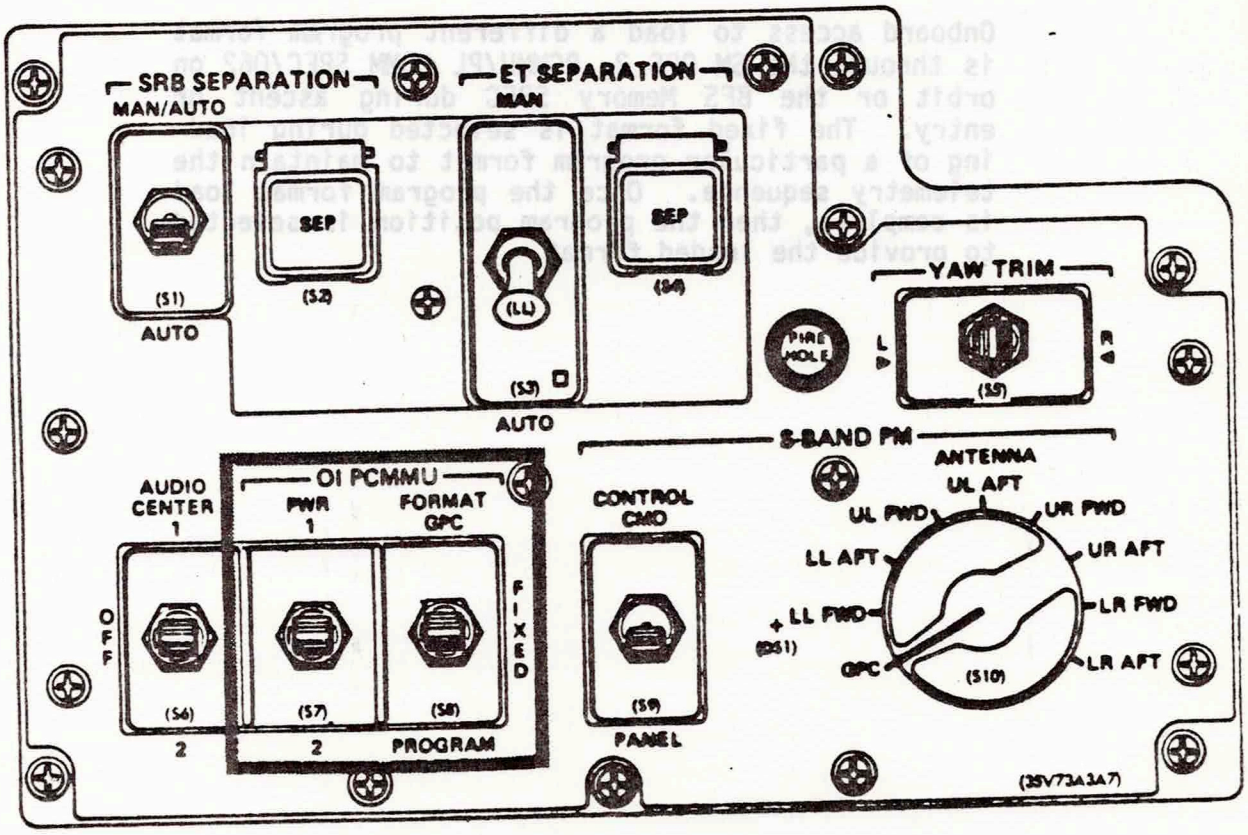


Figure 2-1. OI PCMMU Switches
Panel C3

2.2 SIGNAL STRENGTH MG&GR (Panel A1U)

(Reference Figure 2-2.)

NOMENCLATURE		FUNCTION
SIGNAL STRENGTH		
METER	ind	Displays RCV Signal Strength for the S-BD PM, K-BD or S-BD PL COMM Links. Indicator range is 0-5 relative.
		NOTE The signal strength meter indicates the state of the RCV link and is used with the S-BD PM SYS for manual selection of best antenna. The S-BD PM signal strength is also displayed on the DC AMP/ SIG STR IND on Panel F9 and the SM OPS 2011 Antenna Management display.
SIGNAL STRENGTH	sw	
S-BAND PM		Selects S-Band PM RCV signal strength on the signal strength meter.
KU		Selects K-BD RCV signal strength on the signal strength meter.
S-Band PL		Selects the S-Band Payload RCV signal strength.

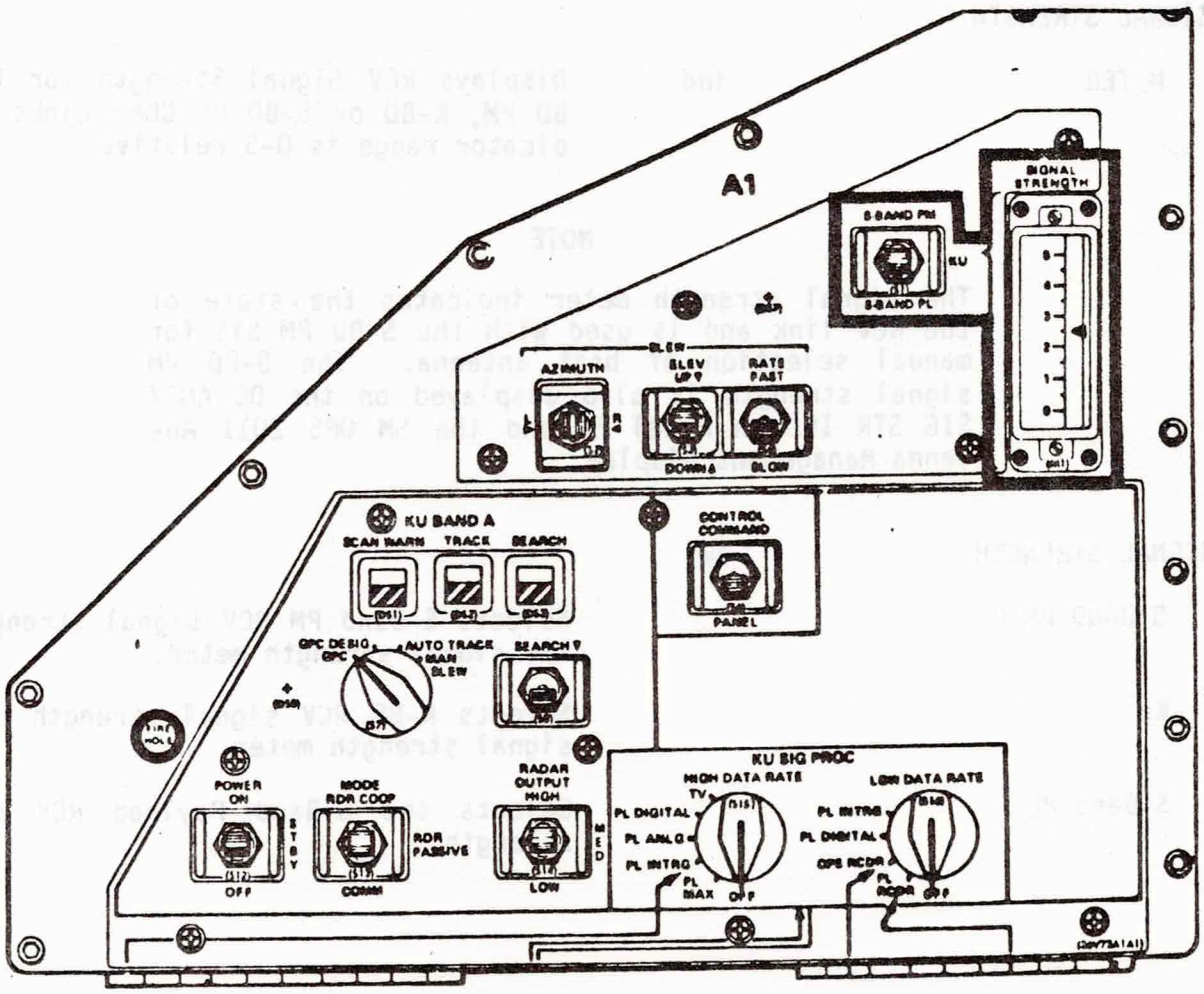


Figure 2-2. S-BD Payload Signal Strength Panel A1U

2.3 S-Band Payload (Panel A1L)

(Reference Figure 2-3.)

NOMENCLATURE		FUNCTION
S-BD PAYLOAD		Provides panel control of the S-Band Payload Subsystem Link Replaceable Units (LRU's).
CONTROL	sw	Selects the S-Band payload LRU control source.
COMMAND		Enables LRU control capability via the GCIL controller, through CMD's from the Orbiter Keyboard or by uplink.
		NOTE Orbiter keyboard access to the GCIL is via the DPS Utility/SPEC 1 Real Time Command (RTC) entry area.
PANEL		Enables LRU control from the S-Band payload subsystem panel.
ANT POLAR	sw	Provides for selection of PI antenna polarity.
L CIRC		Selects the PI left circularly polarized antenna.
R CIRC		Selects the right circularly polarized antenna.
		NOTE The selection of left or right circular antennas is dependent on the polarity of the payload's antenna.

NOMENCLATURE		FUNCTION
XMTR PWR	sw	Selects PI transmitter pwr.
H1 (MED,LO)		Enables a HIGH (MED, LOW) power transmitter output.
CHANNEL SELECT		Provides interrogrator channel selection.
INTRL 1(2)	tw's	Provide for INTRG 1(2) channel selection.

NOTE

Each interrogator channel is defined by a specific XMIT/RCV frequency pair. NASA channels are 001-808 for STDN and 850-882 for Deep Space Network (DSN). DOD channels are 900-919 for SGLS.

FREQ SWEEP	sw	Enables the xmitter to sweep over a range of freq for fixed frequency payload RCVR acquisition.
ON(OFF)		Momentarily enables the PI Xmitter Sweep function.

NOTE

Acquisition is the process of detecting a signal and is comparable to selecting a station on a radio. If the signal is strong, (i.e., the radio is tuned to the station), acquisition is immediate. If the signal is weak, (the radio is not tuned exactly to the station), a process of manual sweeping is used, with detection being determined by the signal amplitude (the station's broadcasts sound louder. Upon satisfactory detection, acquisition is terminated.

NOMENCLATURE		FUNCTION
MED	sw	Controls modulation, the process of translating information to a different media.
ON(OFF)		Enable (Disables) the modulation progress.
Power		
System	sw	S-BAND System Power.
1(2)		Enables power to string 1(2)
Select	sw	Selects which LRU's within a string are to be powered.
INTRG		Enables power to the PI only.
BOTH		Enables power to both the PI and the PSP.
PSP		Enables power to the PSP only.

NOTE

PI 1/PSP 1 are System 1, and PI 2/PSP 2 are System 2.

NOMENCLATURE		FUNCTION
PSP CMD OUTPUT	SW	Provides PSP CMD output selection.
INTRG		Enables PSP/Interrogator CMD interface.
PLUMB		Enables PSP/PL umbilical CMD interface.
		NOTE The payload umbilical is a hardline connection to attached payloads.
PL DATA INTLVR		Interleaves TLM from several payloads for incorporation into the OI PCMMU TLM stream.
POWER	SW	
ON(OFF)		Enables (Disables) power to the PDI.

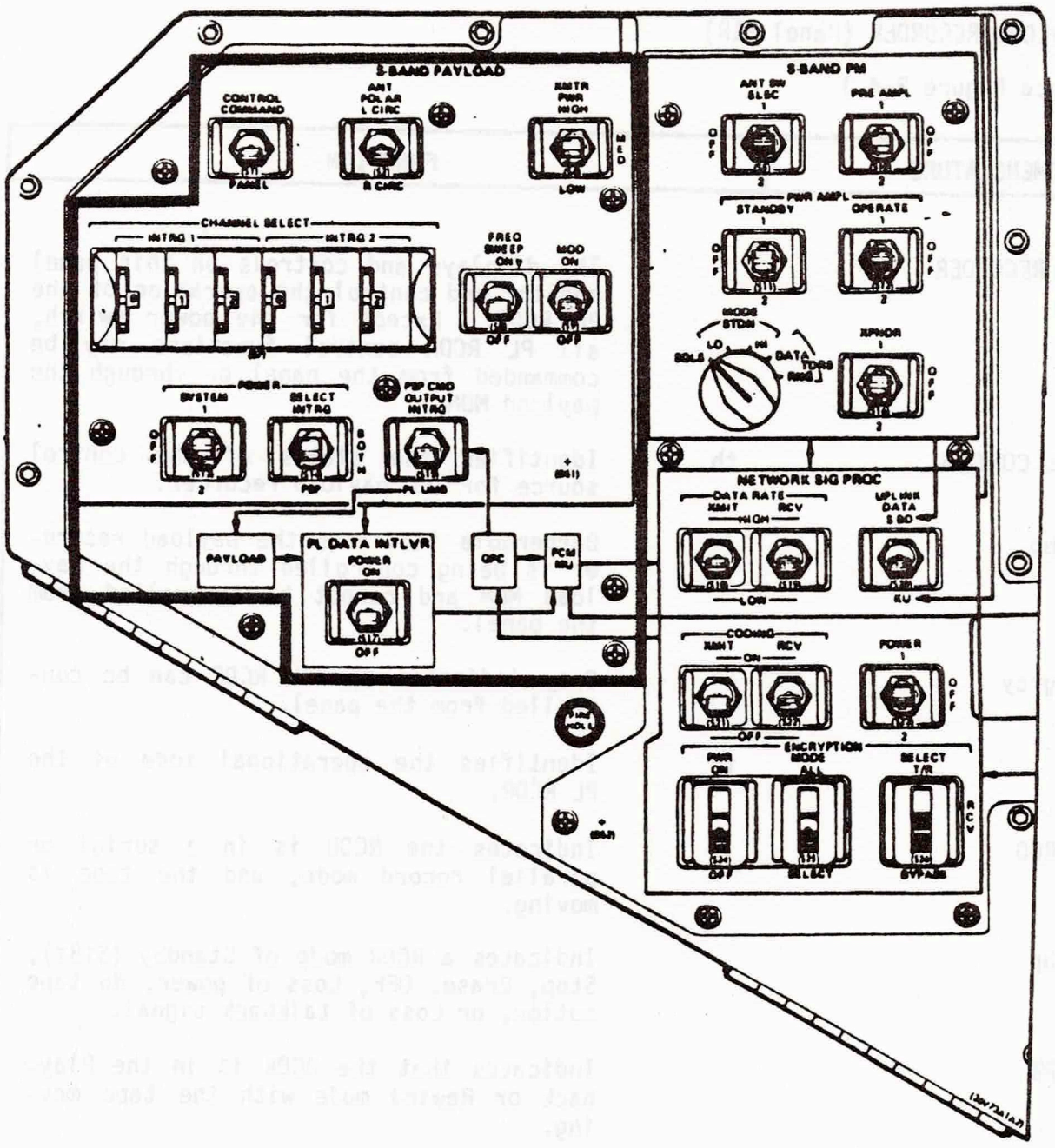


Figure 2-3. Payload Interrogator, Signal Processor and Data Interleaver Panel A1L

2.4 PAYLOAD RECORDER (Panel A1R)

(Reference Figure 2-4.)

NOMENCLATURE		FUNCTION
PAYLOAD RECORDER		The displays and controls on this panel monitor and control the operation of the PL RCDR. Except for the power switch, all PL RCDR control functions may be commanded from the panel or through the payload MDM.
PANEL CONTROL	tb	Identifies the status of the control source for the payload recorder.
bp		Barberpole indicates the payload recorder is being controlled through the payload MDM and cannot be controlled from the panel.
gray		Gray indicates the PL RCDR can be controlled from the panel.
MODE	tb	Identifies the operational mode of the PL RCDR.
RCD		Indicates the RCDR is in a serial or parallel record mode, and the tape is moving.
bp		Indicates a RCDR mode of Standby (STBY), Stop, Erase, OFF, Loss of power, No tape motion, or Loss of talkback signal.
PB		Indicates that the RCDR is in the Playback or Rewind mode with the tape moving.
FUNCTION	sw	This sw provides a means by which the operations mode and tape speed can be selected without initiating tape operation until the operator is ready.

NOMENCLATURE	FUNCTION
OPERATE	In this position the PL RCDR responds to the MODE and SPEED selection.
MODE SEL	In ths position, power is removed form the MODE and SPEED selection sw so the RCDR will not respond to the mode settings.
ERASE	Provides a signal which initiates an erase function. The MODE sw must be in the ERASE position and the FUNCTION sw held for one minute and 10 seconds to initiate an erase sequence.
	NOTE The erase sequence rewinds the RCDR to the beginning of tape (BOT) at 120 ips, erases from BOT to end of tape (EOT) at 60 ips, and returns to the BOT at 120 ips. The sequence requires 12 to 18 minutes.
MODE rot	Provides mode selection for the PL RCDR tape operation.
ERASE	Provides power to the function sw for the erase function.
SERIAL PB FWD	Provides selection of playback from one track in the forward direction at the speed selected by the SPEED sw.
	NOTE Track selection is by PL MDM CMDS, normally provided by uplink.

NOMENCLATURE	FUNCTION
SERIAL RCD	Provides selection of recording data on one track in the forward direction at the speed selected by the SPEED sw.
STOP	The tape does not move with the FUNCTION sw in the OPERATE position.
PRL RCD	Provides forward recording of parallel data on two to 14 tracks at the speed determined by the SPEED sw.
PRL PB REV	Provides parallel data playback in the reverse direction at the speed determined by the SPEED sw.
PRL PB FWD	Provides parallel data playback in the forward direction at the speed determined by the SPEED sw.

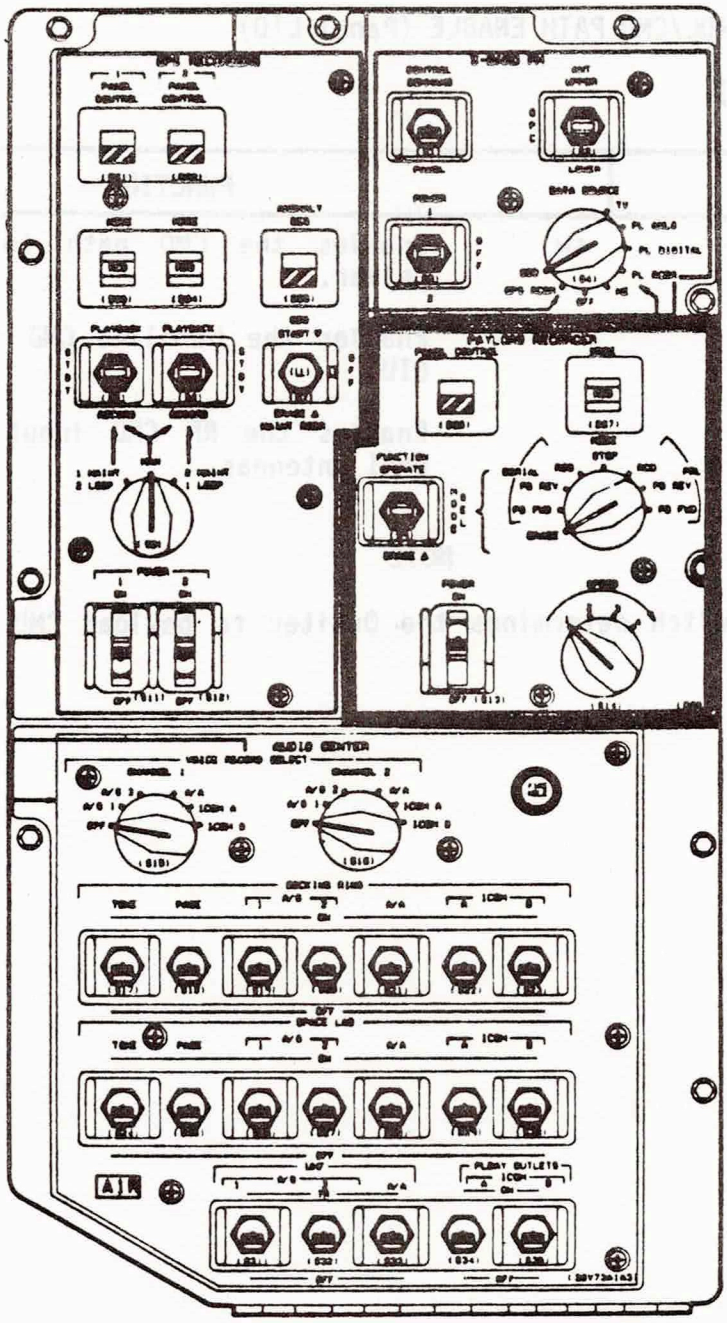


Figure 2-4. Payload Recorder Controls
Panel A1R

2.5 (IUS) POWER CONTROL/CMD PATH ENABLE (Panel L10)

(Reference Figure 2-5).

NOMENCLATURE		FUNCTION
CMD PATH ENABLE	sw	Enables the CMD path to the IUS receiver.
HARDLINE		Enables the hardline CMD input from the CIU.
RF		Enables the RF CMD input from the IUS OMNI antennas.

NOTE

This switch determines the Orbiter to payload CMD path.

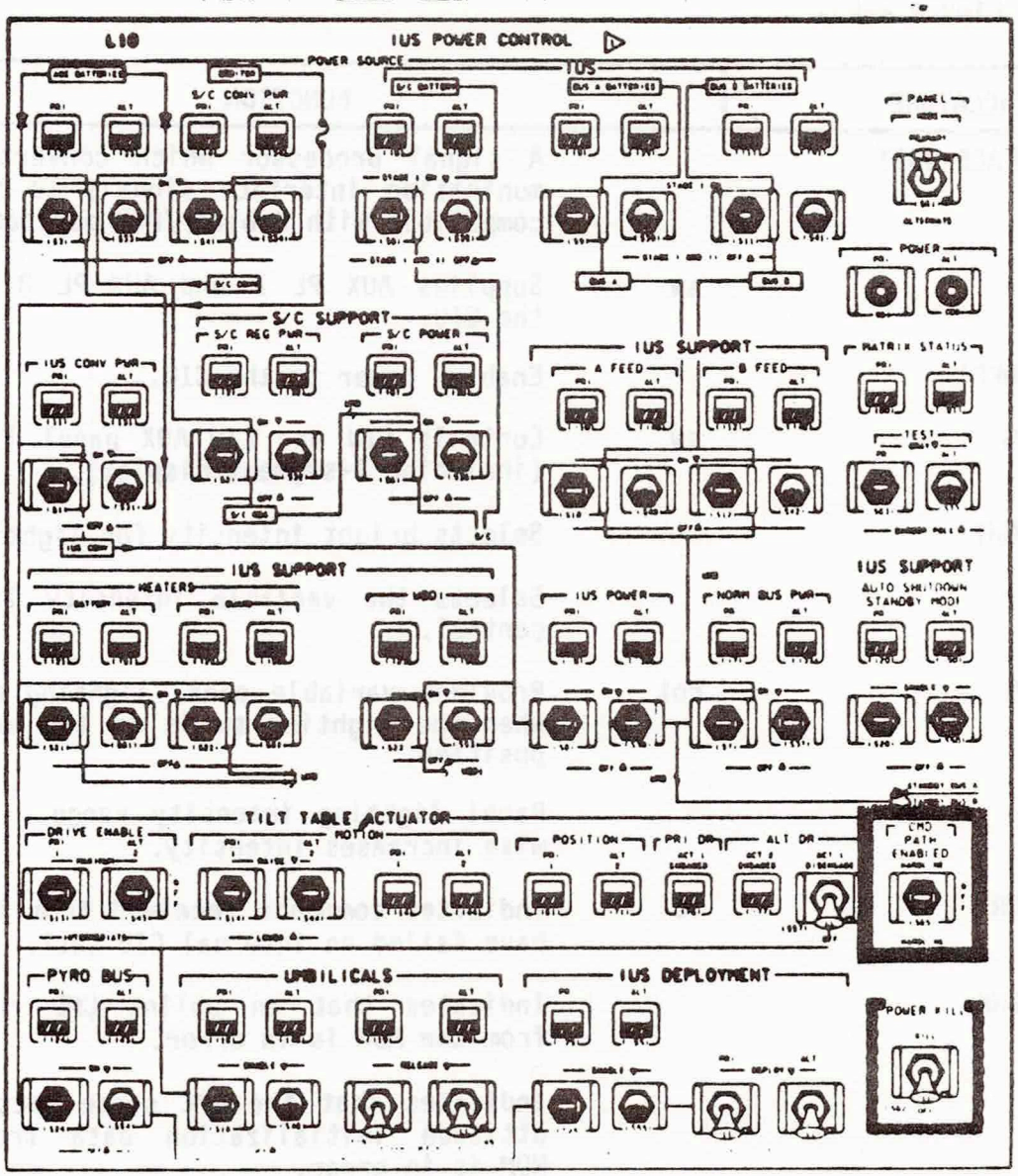


Figure 2-5. IUS Power Control
Panel L10

2.6 COMMUNICATION INTERFACE UNIT (CIU) (Panel L11L)

(Reference Figure 2-6).

NOMENCLATURE		FUNCTION
COMM INTERFACE UNIT		A signal processor which converts communication interface signals to formats compatible with Orbiter/DOD payload.
POWER	sw	Supplies AUX PL A and AUX PL B pwr to the CIU.
ON(OFF)		Enables power to the CIU.
LIGHTING	sw	Controls CIU and CIU AUX panel lighting (including 1-segment display).
BRIGHT		Selects bright intensity for lighting.
VAR		Selects the variable intensity lighting control.
LIGHTING	rot	Provides variable panel lighting control when the lighting sw is in the variable position.
LOW MED		Panel lighting intensity range. Clockwise increases intensity.
MDM ERROR	lt	Indicates commands received from the MDM have failed an internal CIU test.
UPLINK		Indicates that an uplink CMD received from the MDM is in error.
GPC		Indicates that the GPC state vector and attitude initialization data from the MDM is in error.

NOMENCLATURE		FUNCTION
		NOTE MDM lights can be extinguished by depression of the CLEAR pb.
COMMAND		These controls are used to initiate on-board commands and to set up the CIU to accept Orbiter state vector and attitude data.
SELECT	tw	Provides for manual selection of an OCTAL CMD code.
CMD REJECT	lt, (BLUE)	Indicates that TLM verification of a CIU CMD was not detected
		NOTE CMD REJECT is used for encrypted commands only.
GENERATION		These pb's are used to generate CMD's corresponding to the OCTAL CMD code on the select tw's.
CLEAR	pb	Resets the MDM ERROR lights, CMD REJECT lights, and LOGIC. Blanks the CMD word display and turns off the lamp test.
ENTER	pb	Enters the COMMAND WORD associated with the select tw setting into the CIU CMD transmitter buffer.

NOMENCLATURE		FUNCTION
SEND	pb	Transmits CMD from CIU CMD transmission buffer to the PL (IUS) and blanks the CMD word display. If the CMD requires TLM verification, the display will blank, and the status data will appear.
VERIFICATION CMD WORD	lt	Displays the contents of the command buffer in hexadecimal*.

NOTE

The two right-most digits of one display are also used to provide feedback on the execution status of the payload attitude initialization and state vector initialization commands.

VCC-OCTAL	lt	The vehicle CMD count is an octal display that provides indication that the CIU's display is locked to the PL TLM.
MICRPROCESSING		When in a secure mode this display will feed count for all CMD words successfully verified by the PL Inertial Upper Stage (IUS).

NOTE

An NL indication on the VCC-OCTAL display indicates that the CIU's display microprocessor is not locked onto the PL (IUS) TLM stream. A CL indicates a CLEAR mode lock, i.e. a lock only while in a non-secure mode. In a secure mode only, an NL or the CMD count VCC is displayed. LOCK or NO LOCK indications are only pertinent to crew display. Payload TLM is throughput to the PDI and other Orbiter subsystems.

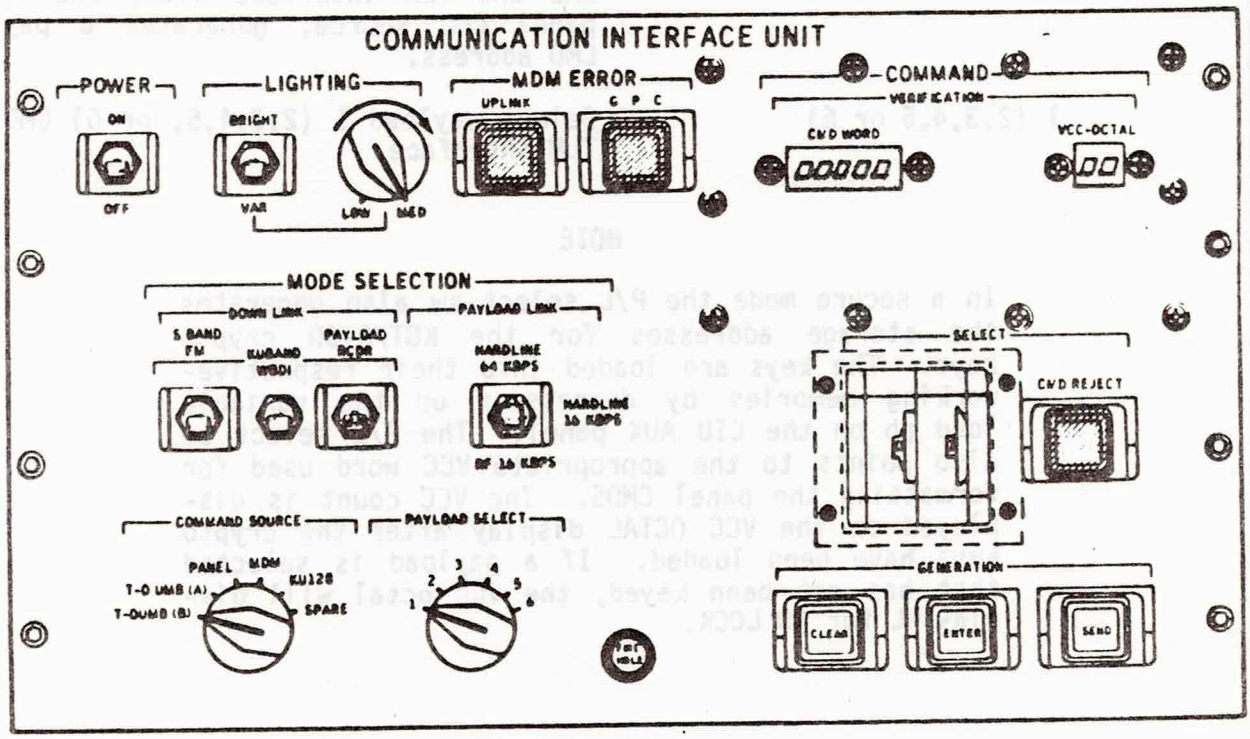
NOMENCLATURE		FUNCTION
MODE SELECTION		Selects the modes of the PL COMM links.
DOWN LINK		Selects the payload data source, for downlink or recording.
S-BAND FM	sw	S-BD FM downlink.
WBDI		Selects the Wideband Data Interleaver (WBDI) as output total RM system.
TLM		Selects the PL TLM.
		NOTE The WBDI interleaves data from several payloads.
KU-BAND	sw	K-Band COMM downlink.
WBDI		Selects the WBDI as output to the K-BD system.
TLM		Select the PL TLM as output to the K-BD system.
Payload RCDR	sw	PL RCDR.
WBDI		Selects the WBDI as output to the PL RCDR.
TLM		Selects the PL TLM as output to the PL RCDR.

NOMENCLATURE		FUNCTION
NOTE		
Configuration of S-BD FM and K-BD systems determines if TLM is downlinked.		
COMMAND SOURCE	sw	Selects source of payload commands.
T-O UMB (B)		Selects the T-O umbilical A for pre-launch payload checkout.
T-O UMB (A)		Selects the T-O umbilical B for pre-launch payload checkout.
PANEL		Selects CIU panel.
MDM		Selects the PF-1 MDM as CMD source. (Uplink CMDS through the PF1 MDM are received via the GPC's from the S-BD sys or the K-Band Sys.)
KU128		Selects the K-BD signal processor HDR output (128 KBPS) as the source of uplink CMDS.
SPARE		Spare CMD source input.
PAYLOAD LINK	sw	Enables the payload CMD and TLM link interfaces.
Hardline 64 KBPS		Enables the 64 KBPS hardline CMD and TLM link interface.
Hardline 16 KBPS		Enables the 16 KBPS hardline CMD and TLM link interface.
RF 16 KBPS		Enables the 16 KBPS PI CMD and TLM link interface.

NOMENCLATURE		FUNCTION
Payload Select	sw	Selects which payload link the CIU has CMD and TLM interface with, and for a panel CMD source, generates a payload CMD address.
1 (2,3,4,5 or 6)		Select payload 1 (2,3,4,5, or 6) CMD and TLM interface.

NOTE

In a secure mode the P/L select sw also generates the storage addresses for the KGT/R-60 crypto keys. The keys are loaded into their respective-working memories by depression or the variable load pb on the CIU AUX panel. The P/L select sw also points to the appropriate VCC word used for formatting the panel CMDS. The VCC count is displayed on the VCC OCTAL display after the crypto keys have been loaded. If a payload is selected that has not been keyed, the VCC octal will display NL for NO LOCK.



RED LIGHT

BLUE LIGHT

Figure 2-6. Communication Interface
Unit Controls And Displays
Panel L11L

2.7 COMMUNICATION INTERFACE UNIT AUXILIARY CONTROLS (PANEL L11U)

(Reference Figure 2-7).

NOMENCLATURE		FUNCTION
COMM INTERFACE UNIT AUX CONT		Provides controls and displays for the secure-OPS encryption process.
MEMORY ZEROIZED	lt (BLUE)	Light illuminates to indicate that the KG Transmitter and RCVR (KGT/R) codes have been erased from memory.
		NOTE Memory erasure occurs whenever the encryptor zeroize switch (SI2) on PANEL R12 is activated to the zeroize-position or there is a 7-second power interruption to the KGT/R memory.
FAULT ALARM	lt(BLUE)	Illuminates to indicate a KG BOX self-test has failed.
CMD		KG transmitter has failed a self-test.
TLM		KG RCVR has failed a self-test.
		NOTE If a crew CMD transmission were attempted, the CIU panel CMD REJECT light would illuminate with a CMD FAULT ALARM. Also, an NL indication would be received in conjunction with a TLM FAULT ALARM light.
MODE	lt(AMBER)	Indicates the mode of the KGT-60
CLEAR		KGT-60 is not encrypting CMDS
		NOTE The CLEAR indication is present when then CLEAR/SECURE-sw is in a cursor position (non-encryptor) or a KGT-60 fault when the CLEAR/SECURE sw is in a secure-position.

NOMENCLATURE		FUNCTION
POWER	sw	Enables power to the KGT/R.
OPERATE		Enables power to all the KGT/R circuitry.
STANDBY		Enables power only to the volatile memory of the KGT/R.
VARIABLE LOAD	pb	This pushbutton is used to load the crypto-key loaded at the address pointed to by the P/L SELECT sw (on L11L) into the KGT/R's working memory.
CLEAR/SECURE	sw(□)	Clear indication that crew CMDS are not encrypted. SECURE indicates that crew CMDS are encrypted.

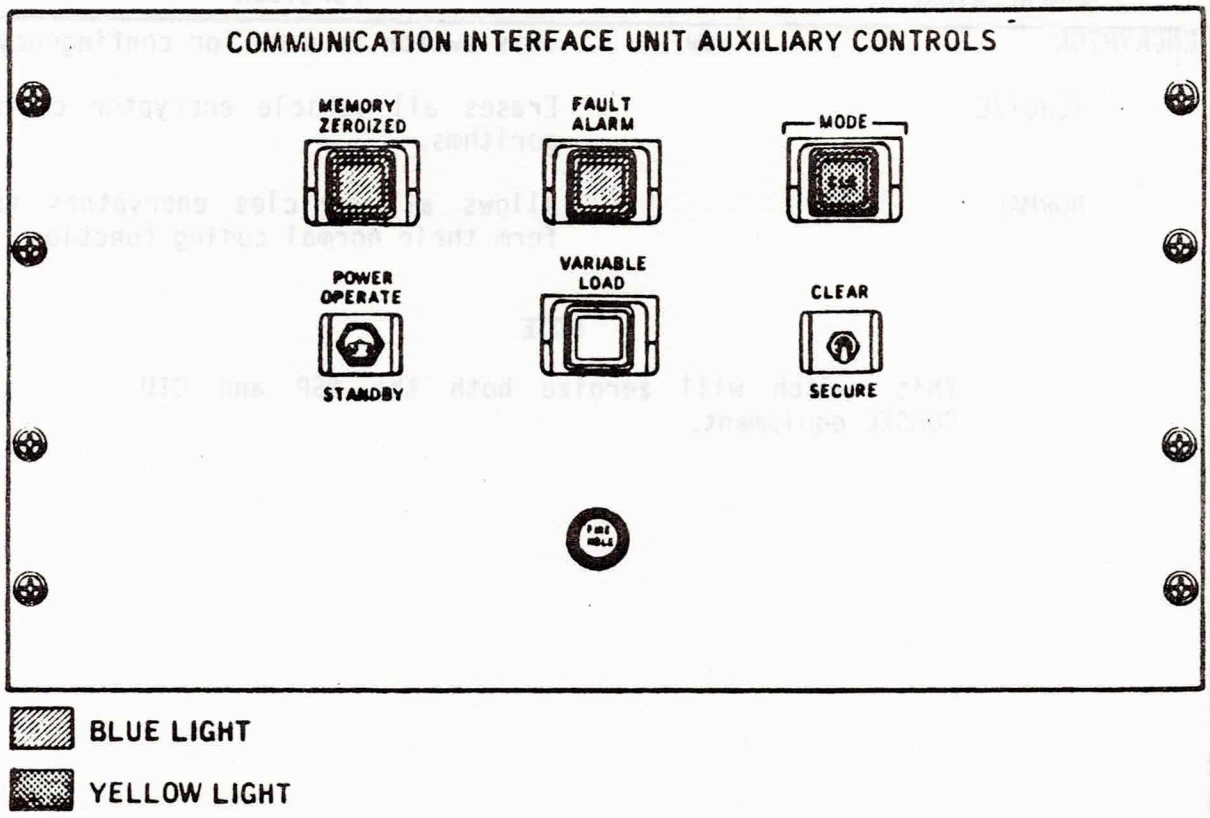


Figure 2-7. CIU Auxiliary Panel Display and Controls
Panel L11U

2.8 ENCRYPTOR SWITCH (Panel R12A2)

(Reference Figure 2-8.)

NOMENCLATURE		FUNCTION
ENCRYPTOR	SW	This switch is used for contingency.
ZEROIZE		Erases all vehicle encryptor coding algorithms.
NORMAL		Allows all vehicles encryptors to perform their normal coding function.

NOTE

This switch will zeroize both the NSP and CIU COMSEC equipment.

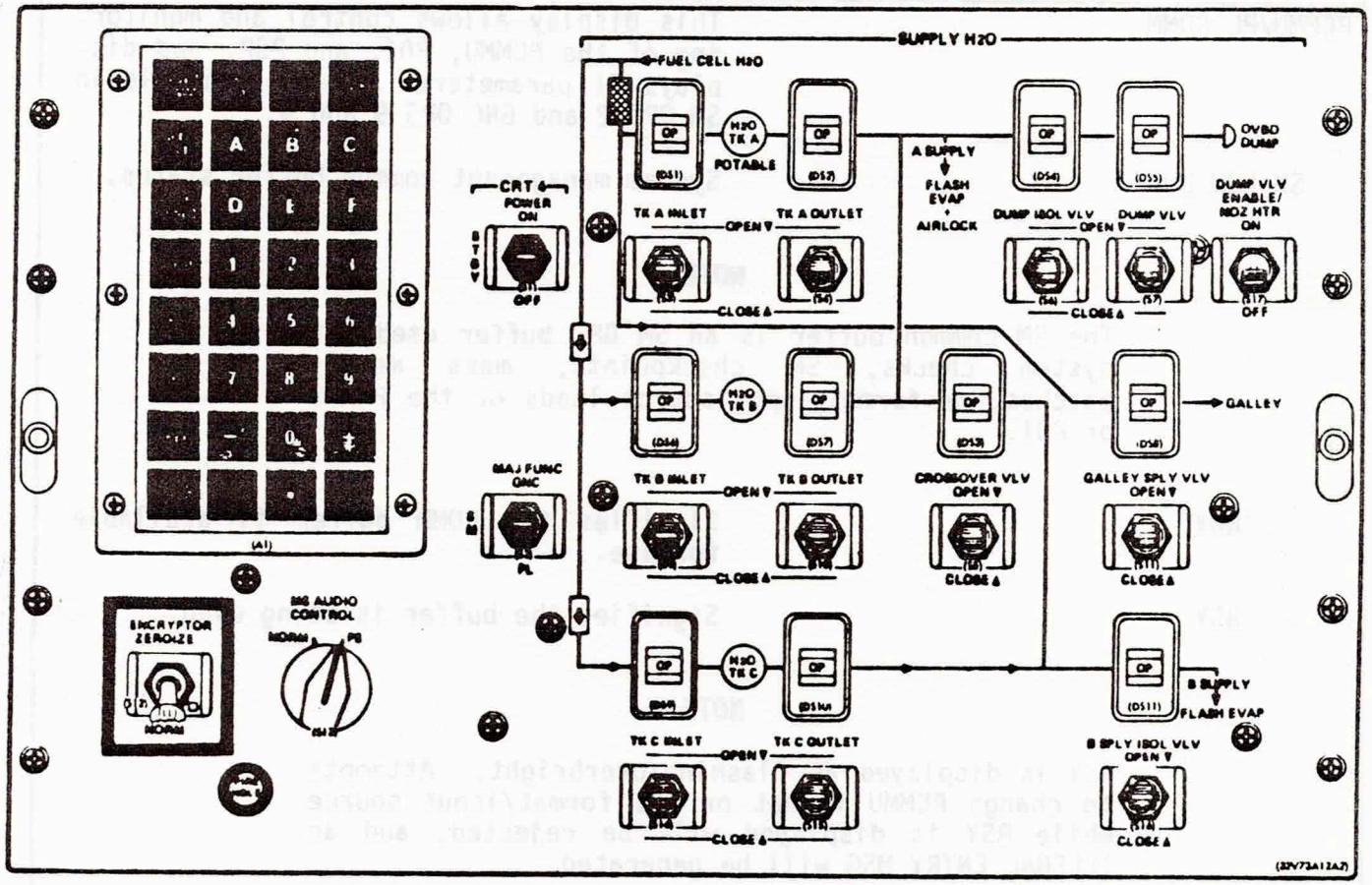


Figure 2-8. Encryptor Switch
Panel R12A2

2.9 SM SPEC 62 PCMMU/PAYLOAD COMMUNICATION

(Reference Figure 2-9.)

NOMENCLATURE	FUNCTION
PCMMU/PL COMM	This display allows control and monitoring of the PCMMU, PDI, and PSP, and displays PI parameters. It is available in SM OPS 2 and GNC OPS 9 and 4.
SM COM BUFF	System management common buffer status.
	NOTE The SM common buffer is an SM GPC buffer used for system checks, SM checkpoints, mass memory patches, or format/input source loads of the PCMMU or PDI.
RDY	Signifies the COMM buffer is available for use.
BSY	Signifies the buffer is being used.
	NOTE BSY is displayed as flashing/overbright. Attempts to change PCMMU format or PDI format/input source while BSY is displayed will be rejected, and an ILLEGAL ENTRY MSG will be generated.
PCMMU	PCMMU control and monitoring is accomplished by the entries and measurements on this portion of the display.
BITE WORD	A hexadecimal display of the built-in test equipment status register of the PCMMU.
	NOTE The BITE word is used primarily by ground personnel as an aid in determining the operational state of the PCMMU.

NOMENCLATURE	FUNCTION
FMT	Item entries and status parameters used for PCMMU formatting.
	NOTE A format is a program used to determine what and when data is output. The use of this display to format the PCMMU is dependent on the OI PCMMU format sw on C3 being in the GPC position.
SEL FXD IXS	Selects an HDR format as defined by the PROM.
PGM 2XS	Selects an HDR/LDR format as defined by the RAM.
	NOTE Fixed format is selected during loading of a particular program format into the RAM memory, to maintain the telemetry sequence. Once the program format load is complete, then the program entry is keyed to provide the loaded format.
FMT	
PGM ID 64XXX	Displays the format number or the current 64 KBPS format problem.
128 XXX	Displays the format number of the current 128 KBPS format program.
	NOTE The PCMMU outputs both a 64 and a 128 KBPS data stream to the NSP. Which data stream is used is determined at the NSP by the NSP data rate.

NOMENCLATURE	FUNCTION
3 SEL ID XXX	Allows for selection of a programmable format (1-127 for the 64 KBPS and 128-254 for the 128-KBPS).
LOAD 4 XXX	Initiates the load process that transfers the format selected in Item 3 from the MMU through the SM common buffer to the PCMMU's format.
RUN	Indicates a load is in progress.
FAIL	Indicates an unsuccessful load.
CPLT	Indicates a load is completed.

NOMENCLATURE	FUNCTION
	NOTE Upon Completion of a successful load, the format number for the appropriate PGM ID is updated to agree with the Item 3 selection. The load status parameter is retained during OPS S2 to S4 or S4 to S2 transitions only and will be displayed upon SPEC recall.
I/O RESET	Enables GPC/PCMMU Communications
PMC 5XX	An asterisk will be displayed after this item when no Bus Control Element (BCE) bypass exists, and an M if a BCE bypass exists.
	NOTE The GPC's are assigned strings of equipment to poll or monitor for data transactions. These strings are called BCE strings. A bypass occurs when consecutive GPC data requests to specific buffer equipment fail. At this point the GPC issues a BCE string MSG declaring that it will not request data from that equipment until an I/O reset is performed.
PSP	PSP control and monitoring are accomplished by item controls and measurements on this portion of the display.
I/O Reset	Initiates PSP communications with the PI and/or attached payloads.
PSP1 6XX	Resets PSP1 I/O.
PSP2 7XX	Resets PSP2 I/O.

NOMENCLATURE	FUNCTION
PSP	
SYNC Bit XXXS	Displays YES or NO as an indication of bit sync.
Frame XXXS	Displays YES or NO as an indication of frame sync.
	NOTE Bit and frame sync YES indicate that the PSP is properly processing data.
LOAD XXXX XXXX	The first dynamic status field indicates the status of PSP configuration load status. This field is blank when the load is in progress, RJCT when a PSP config CMD has been rejected, and INCP to indicate that a PSP CMD load was incomplete. The second dynamic status field displays a double overbright remote text to identify which PSP command issuer is the source of a rejected or imcomplete load: Time Executed Command (TEC); Payload Control Supervisor (PCS); Cargo Control Spec (CC); Uplink (U/L); Guidance, Navigation, and Control (GNC); and MULT (more man one PSP CMD issuer).
	NOTE PSP configuration commands are commands that configure the PSP to interface with a particular payload. Through-put commands to a given payload are always preceded by a configuration CMD.
PL INTRG	PI monitoring is accomplished by measurement on this portion of the display.
1 CHANNEL XXXS	Displays the PI 1 channel selected.

NOMENCLATURE	FUNCTION
2 CHANNEL XXXS	Displays the PI 2 channel selected.
	NOTE The channel numbers are BLANK when PI 1(2) is unpowered.
PHASE LOCK XXXS	Indicates that the PI RCVR has detected a signal. This field displays YES, NO, or blank if both PI's are powered off.
ERR ±XXS	Indicates that the selected PI's RCVR is following any variation of the incoming frequency, by tuning itself to the transmitted signal (similar to the manual tuning of a radio as a station's signal drifts). Phase-error indications vary between ±75 KHz.
	NOTE Phase error can be used to verify two-way lock between the payload's transmitter and the PI's received.
PL INTRG	
XMIT PWR XX.XXS	Displays the selected PI's XMIT power (LO, MOD, or HIGH).
PL SIG STR X.XXS	Displays the relative payload signal strength for the selected PI in a range of 0 to 5.
PDI	This portion of the display provides control and monitoring of the PDI.
I/O Reset 8XX	Provides the capability to restore a bypassed PDI switch matrix read element. An asterisk indicates that no bypass exists. An overbright M indicates a read element bypass.
BITE WORD XXXX	Hexadecimal display of PDI's built-in test equipment status register used

NOMENCLATURE	FUNCTION
	primarily to aid ground personnel.
PDI	**NOTE** Items 9-10 are used to format a PDI decom.
9 SEL DECOM X	Allows selection of a PDI decommutation channel (1-4) or the FPM.
10 SEL FMT XXX	Allows selection of a PDI decom or FPM format for the decom selected by Item 9.
LOAD 11 XXX	Initiates the load process of the decom selected by Item 9, with the format selected in Item 10. The display field indicates RUN while loading is in progress; FAIL, if loading is unsuccessful; and CPLT upon successful load completion.
12 SEL INPUT X	Allows for selection of an input source for the PDI decom selected in Item 9. Entry of 1-5 selects one of five attached payloads; entry of 6 designates the operating PSP as the input source entry, or 0 designates no input.
PDI LOAD 13	Enables the input from the source selected to the decom selected in Item 9.
DECOM STATUS	The feedback remote text, to reflect the selected PDI input source (INPUT) and format (FMT) loaded for each PDI DECOM and FPM (1,2,3,4,5-FPM), is displayed below the item entries and controls. A stand-alone FDA parameter status indicator is provided for the loaded input source to each DECOM 1 through 4 and is displayed after the FMT number. An up arrow indicator will be displayed

NOMENCLATURE	FUNCTION
	whenever a DECOM is lost. Knowing the format number, actual parameters lost from a particular payload can then be identified using a checklist.
DECOM ENA FDA 1 14X 2 15X 3 16X 4 17X	Items 14 through 17 (DECOM FDA 1,2,3,4 ENA, respectively) provide a flip-flop control to enable/disable the FDA (Fault Detection and Annunciation) for the loaded input source to each DECOM 1 through 4. An "*" indicator will be displayed after the item number when FDA has been enabled and is blank when the FDA has been disabled. When SM software is first called, these items will be set to the disable state (i.e, no "*" indicator) and thereafter whenever the diplay is called will reflect the last crew input. The current state of each PDI DECOM FDA GNC item entry will be maintained across each OPS-transition in which the SM major function base is not overlayed.

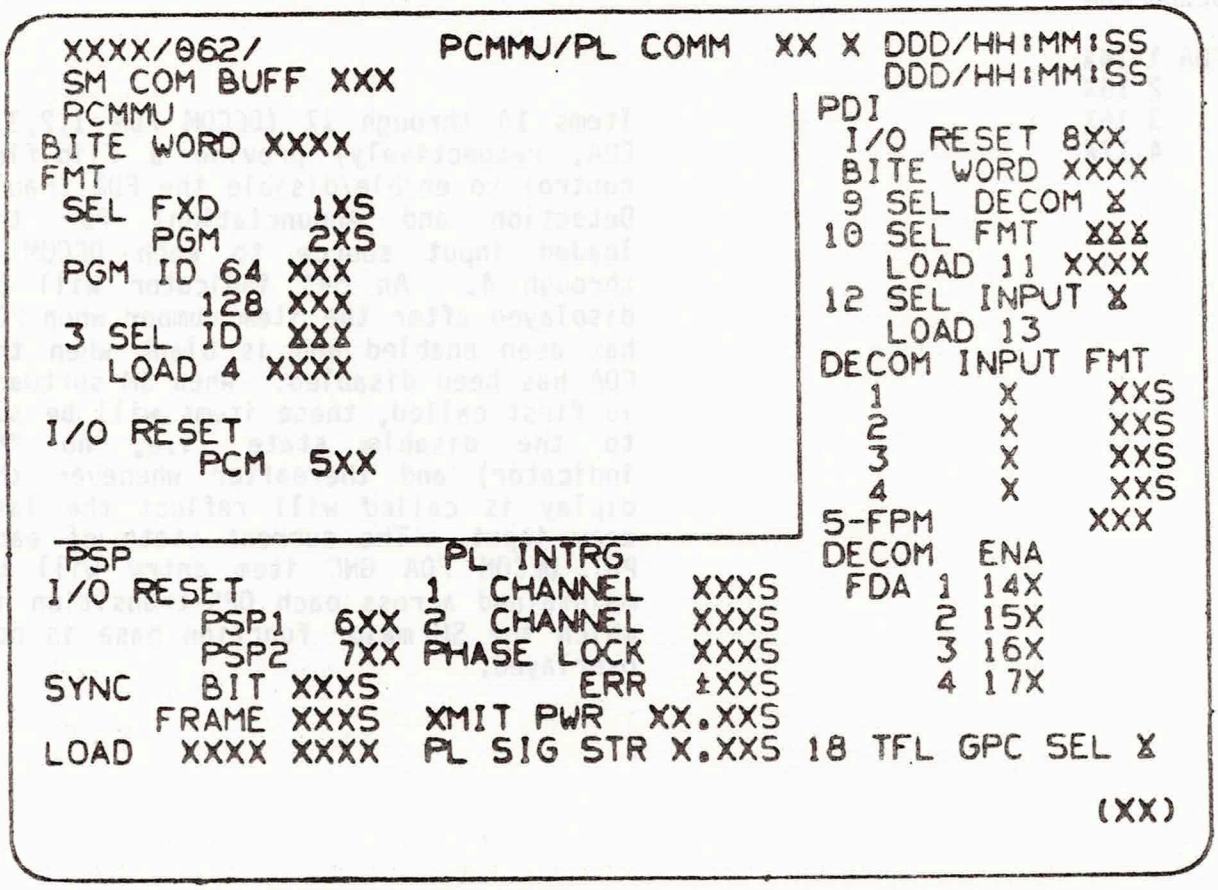


Figure 2-9. PCMMU/Payload Communication Display
OPS 52/SPEC 62 (ORBIT) System Management CRT Display*

*ALSO AVAILABLE IN GNC OPS 9 and 4

2.10 SM SPEC 76 COMM/RDR Payload Recorder

(Reference Figure 2-10.)

NOMENCLATURE	FUNCTION
GCIL CONFIG	A bilevel measurement indicating the configuration of the GCIL controller.
CMD	Indicates that the GCIL control operations are nominal and available for commanding all telecom SYS LRU's.
	NOTE The GCIL allows ground or keyboard CMD (via SPEC 1 DPS utility) to interface with the TELECOM SYS LRU logic, provided the specific subsystems' (S-BDPM, S-BDFM, S-BD payload, K-BD, or CCTV) control sw is in the CMD position
PNL ∮	Indicates that a GCIL problem has defaulted control of all telecom subsystems to their panel switches.
	NOTE Multiple GCIL power supply failures, multiple-electrical bus transient fails, and initial GCIL power-up will result in PNL being displayed. The SM fault MSG indicating this display parameter (PNL ∮) is S76 COMM RCDR.
RECORDERS	The text associated with these parameters indicates the status of the three operational instrumentation magnet tape recorders.
PL	These parameters represent the status of the PL RCDR. An M is driven in the status column for all parameters except TAPE when the associated data is missing.

NOMENCLATURE	FUNCTION
MODE	The modes are identified by the text codes below and are associated with the PL RCDR MODE sw positions on panel A1U or associated real time command identify configurations.
STBY	This code indicates the tape is not moving. The recorder functions are either OFF or in MODE SELECT.
TRK	Indicates which tape track is recording or being played back. The text for this parameter is blank where the recorded POWER sw is OFF or in a parallel mode.
DIR	Indicates which direction the tape is running-forward (FWD) or reverse (REV).
%TAPE	Indicates the percentage of tape which has been used (0-100%). The text increments in steps of 3%.
TAPE	Indicates the tape is running (RUN) or stopped (STOP).
TEMP	Indicates the current head temperature in degrees F. The value is ambient temperature when the tape is stopped and about 90% when the tape is running. The temperature is kept below 90^{0} by a cooling system. An up arrow (↑) will be displayed in the status if 90^{0} is exceeded.
BITE	Indicates the overall status of the recorder. An FL indicates an out of tolerance condition. Power OFF on the A1R PAYLOAD RECORD panel produces this indication.

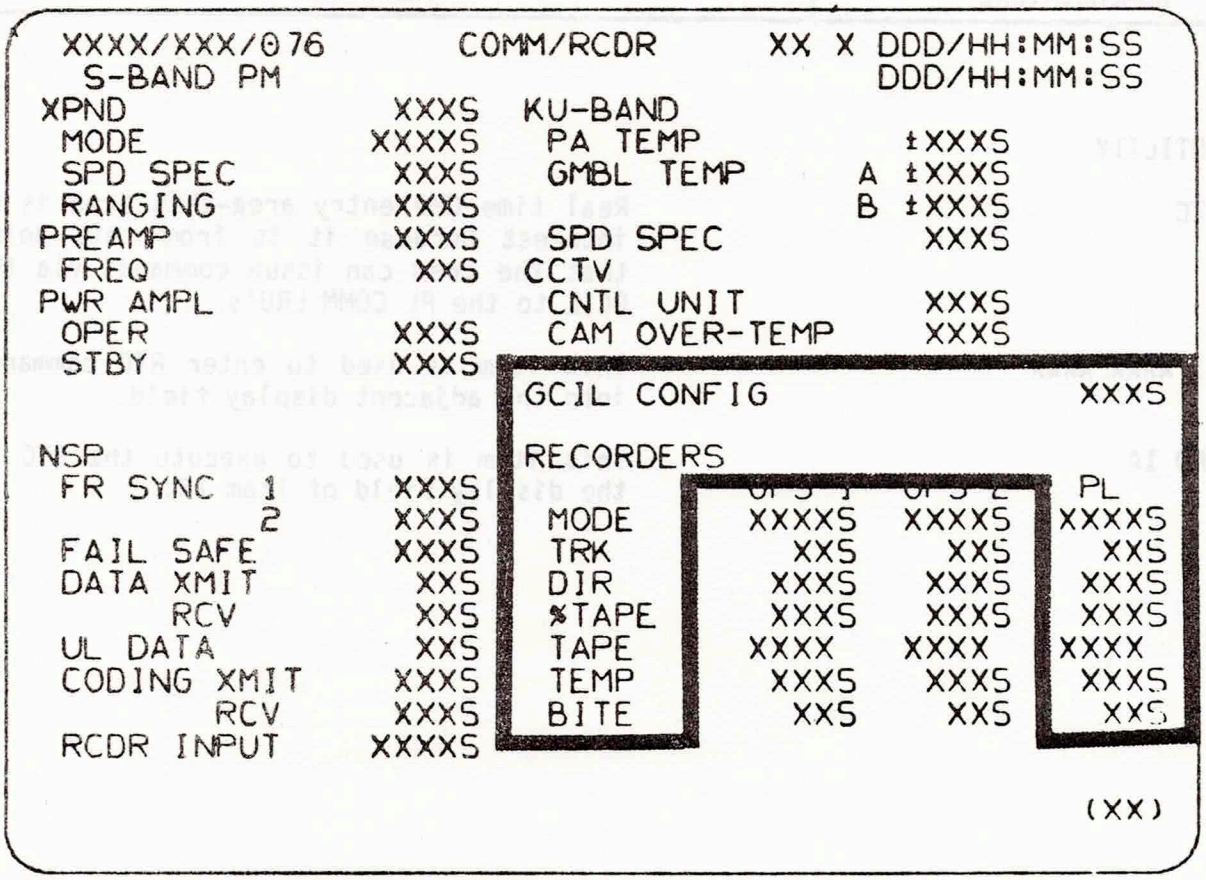


Figure 2-10. Communication/Recorder Display OPS52/SPEC 76
System Management CRT Display

2.11 DATA PROCESSING SYSTEM (DPS)

(Reference Figure 2-11.)

NOMENCLATURE	FUNCTION
DPS UTILITY	
RTC	Real time CMD entry area-this area is of interest because it is from this point that the crew can issue commands via the GCIL to the PL COMM LRU's.
13 XXXX XXXX	This item is used to enter RTC commands into the adjacent display field.
CMD 14	This item is used to execute the RTC in the display field of Item 13.

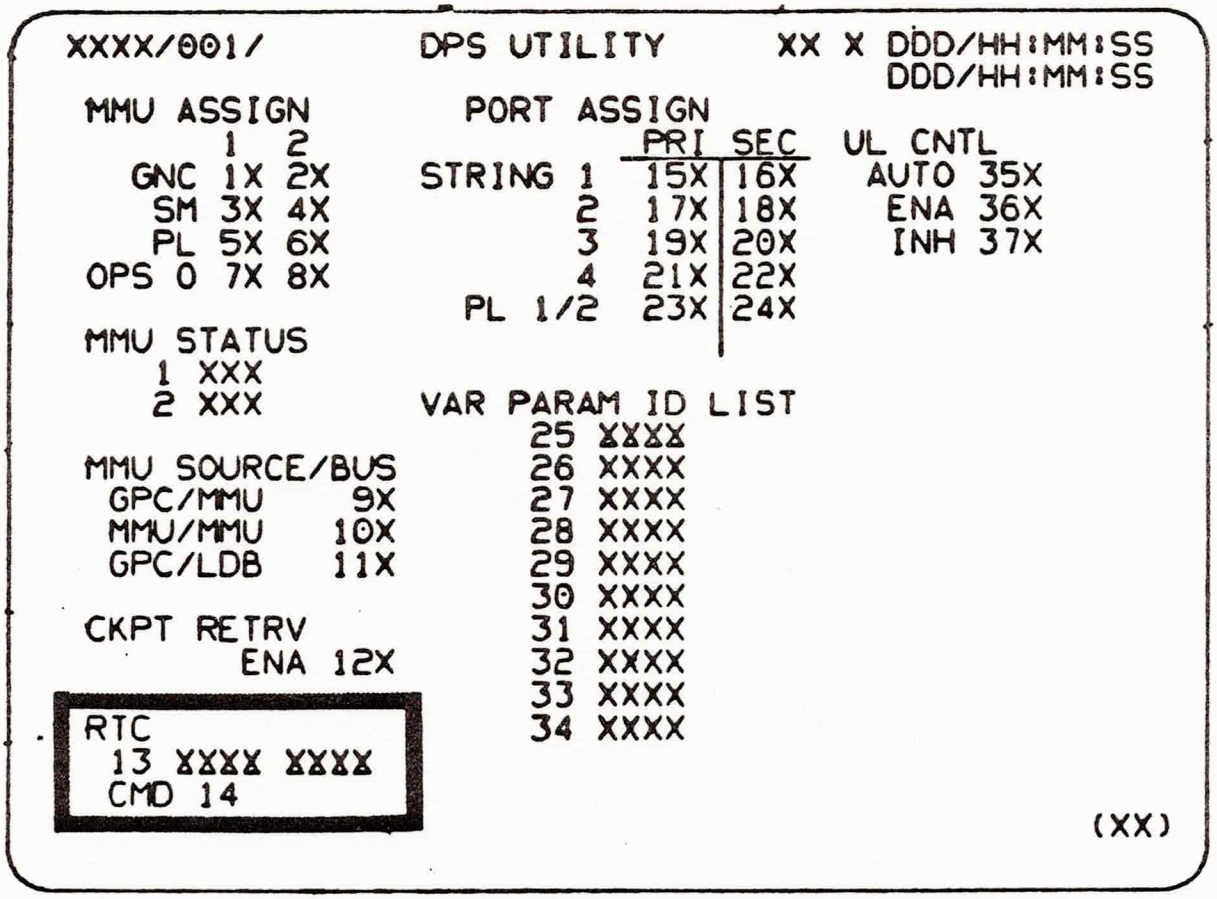


Figure 2-11. DPS Utility *SPEC 1 System Software CRT Display

*NOT AVAILABLE IN OPS 1, OPS 3, or OPS 6

SECTION 3

PROCEDURES

The purpose of this section is to expose crew members to nominal Payload Communication system FDF procedures and rationale.

3.1 CREW INGRESS SWITCH LIST (ASCENT C/L)

The following switch list is presented to the student as a baseline for the Payload Communication system configuration at the time the crew enters the crew station at -Z hours.

LEFT SEAT

C3	OI PCMMU PWR	1
	FORMAT	FXD
AIU	SIGNAL STRENGTH SEL	S-BD PM
AIL	S-BD PL CNTL	CMD
	ANT POLAR	RCIRC
	XMTR PWR	LO
	CH SEL tn (six)	AS REQD
	S-BD PL FREQ SWEEP	OFF
	MOD	OFF
	PWR SYS	OFF
	PWR SEL	BOTH
	PSP CMD OUTPUT	INTRG
	PL DATA INTLVR PWR	OFF
AIR	PL RCDR PNL CNTL tb	bp
	FUNC	OPERATE
	MODE	SERIAL RCD (tb-bp)
	PWR	ON
	SPEED	3
R1242	ENCRYPTOR SWITCH	NORM
LIO	IUS POWER CONTROL XPND CMD SEL	OFF
LIIU	AUX CNTL PNL MODE	CLEAR
	PWR	STBY
LIIL	CIU PWR	ON
	MODE SEL DNLK S-BD FM	TLM
	K-BD	TLM
	PL RCDR	
	PAYLOAD LINK	HARDLINE

CMD SOURCE T-0 UMB(A)
PAYLOAD SEL 1
CMD VERIFICATION VCC-OCTAL CL
CMD WORD 30000

NOTE

Before turning OI PCMMU PWR on C3, indicated by ***, to off, notify the LCC so GRND PWR can be connected; also notify the LCC before turning it to 1 after crew ingress.

3.2 LOAD PCMMU FORMAT PROCEDURE

(For sections 3.2 - 3.3 reference Figure 3-1 on page 3-6.)

PURPOSE:

Given the FDF Post-Insertion Preparation Procedures or the Orbit Operations Checklist, a crew member will correctly perform the load PCMMU telemetry formats procedure.

NOTE

Changes to the PCMMU formats may require PDI DECOM format changes.

LOAD PCMMU FORMAT

C3 1 OI PCMMU FORMAT - GPC

SM 62 PCMMU/PL COMM

CRT 2 FORMAT:
FXD - ITEM 1 EXEC (*)
SEL ID - ITEM 3 +X X X EXEC

3 √ SM COMM BUF - RDY
LOAD - ITEM 4 EXEC
√ LOAD, ITEM 4 - RUN, CPLT

4 If LOAD - CPLT
Repeat steps 2 and 3 for 2nd ID

5 If LOAD - FAIL & ERR MSG -'I/O ERR MMU 1 (2)'
Go to DPS MALF, 5.2a >>

6 If LOAD - FAIL and first load attempt
Repeat steps 2 and 3 for FAIL ID

7 If LOAD - FAIL and subsequent load attempt

C3 OI PCMMU PWR - 2(1)
√ ERR MSG - 'I/O ERR PCM'
- 'I/O ERR DL'

CRT I/O RESET PCM - ITEM 5 EXEC (*)
Repeat steps 2 and 3

8 When final LOAD - CPLT
PGM - ITEM 2 EXEC (*)

PHASE/DOWNLIST/OPS	FORMAT ID	CONFIG
ORB/G2 ORB BURN/G2,S2	64 / 128	NO
ORB/PL PRIME/G2,S2	111 / 161	13
ORB/PL BU/G2,S2	111 / 174	79
FCS CKOUT/G8,S2	111 / 175	80
ENTRY/G3,BFS	104 / 162	19
GPC/G2,S2,DUMP or OPS 0	106 / 163	30
GPC/MMU C/O/G2,S2,P9	106 / 163	32

NOTE

LDR TFL may affect PCMMU BITE. If PCMMU or SM 2 GPC has been switched since last TFL, ID 64 and 128 will not reflect current state.

NOTE

A successful load involves only steps 1-4 and step 8.

3.3 LOAD PDI DECOM FORMAT

PURPOSE:

Given the FDF Post Insertion Procedures or the Orbit Operations Checklist, a crew member will load the PDI DECOMS with a format program.

NOTE

Changes to the PDI DECOM formats may require a PCMMU format change.

LOAD PDI DECOM FORMAT

SM 62 PCMMU/PL COMM

1 PDI:

CRT √ I/O RESET - ITEM 8 (*)
SEL DECOM - ITEM 9 +X EXEC
SEL FMT - ITEM 10 + X X X EXEC
LOAD - ITEM 11 EXEC

2 If LOAD - CPLT
| SEL INPUT - ITEM 12 +X EXEC
| LOAD - ITEM 13 EXEC
| Continue steps 1 and 2 for additional DECOMS/FPM

3 If LOAD - FAIL & ERR MSG -'I/O ERR MMU 1 (2)'
| Go to DPS MALF, 5.2a >>

4 If LOAD-FAIL and first load attempt
| Repeat step 1

5 If LOAD - FAIL and subsequent load attempt

AIL PL DATA INTLVR PWR - OFF, then ON

√ ERR MSG -'S62 BCE BYP PL'
-'S62 BCE BYP PDI'

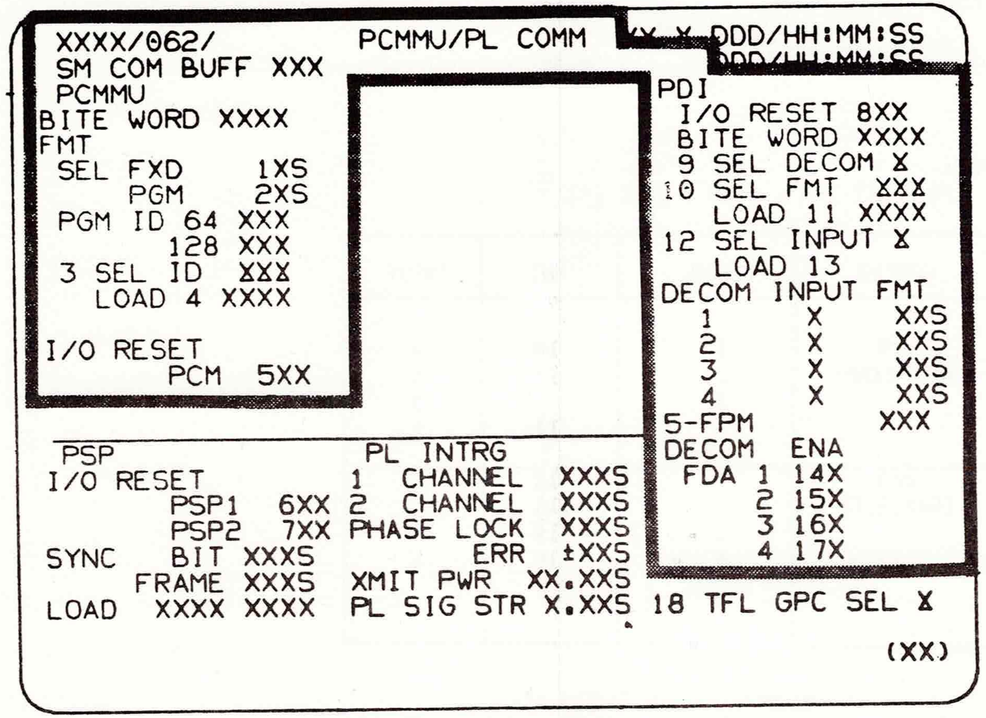
CRT PDI:
I/O RESET - ITEM 8 EXEC (*)
Repeat step 1 for all of config (XXX)

NOTE

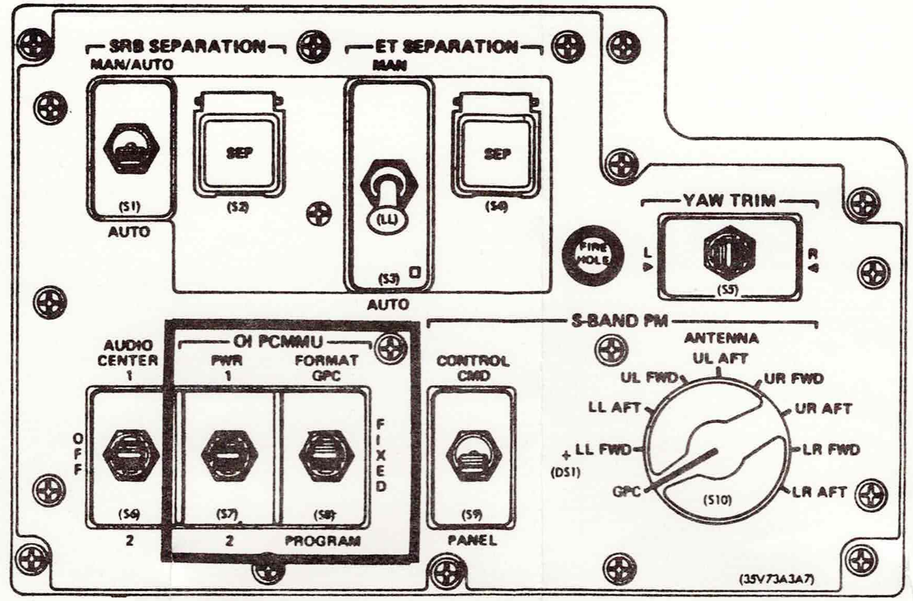
The PDI DECOM format status on S62 is updated only during the load process. For an OPS transition or SM GPC fail the format status is lost. This does not necessarily indicate a PDI format problem. Successful DECOM loads involve only steps 1-2 and step 6.

6 PCM:
I/O RESET PCM - ITEM 5 EXEC (*)

CONFIG	DECOM	FMT	INPUT
079	1	18	2
ORB,PRIME)	2	17	5
	3		0
	4	14	5
	5-FPM	1	
080	1	18	0
(ORB,ALT)	2	16	5
	3	19	2
	4	15	5
	5-FPM	4	



SM62 PCMMU/PL COMM - CRT



PANEL C3 - OI PCMMU SWITCHES

Figure 3-1. Load PCMMU/PDI Formats

The following procedures are for training purposes only. The specific payloads involved will vary from mission to mission.

These RF link checks (Early and Late Part 1) involve a Payload Interrogator interface (PI) via the Payload Signal Processor (PSP) - a NASA Payload COMM RF CONFIGURATION.

3.4 RF LINK CHECKS (EARLY)

(For sections 3.4 - 3.5 reference Figure 3.2 on page 3-15.)

PURPOSE:

Given the FDF Payload Deploy Checklist (as referenced by the Crew Activity Plan), a crewmember will assist with the direct ground to payload link checks and perform Orbiter PI to payload RF link checks (one-way link).

NOTE

The early link checks involve no payload RF transmission. For specific missions there may be no early RF link checks.

1: GNC UNIV PIG 3: OFF	2: SM 78 SYS SUMM 4: SM 200 IUS/TDRS

RF LINK CHECKS (EARLY) (~3:01 ORB 3)

1 IUS (DIRECT)

MS1 L10 CMD PATH ENA - RF

Crew advises MCC - RF CMD PATH ENA
When MCC advises test complete or at LOS:
CMD PATH ENA - HDLN

********** GDS LOS **********
********** VTS LOS ********** (~ 3:10)

2 TDRS (PI) SETUP

PSP/PDI SETUP:

CRT 4: SM 62 PCMMU/PL COMM
I/O RESET PSP 1 - ITEM 6 EXEC (*)
Verify configuration of PDI

PDI	DECOM	INPUT	FMT
√	1	2	18
√	2	5	17
√	3	0	
√	4	5	14
√	5-FPM		1

********** MIL AOS ********** (~ 3:10)

MCC transmits PSP cmd load

NOTE

Step 1-15 is a direct check. Panel L10 is a payload specific panel. Step 2 involves setting up a PI/payload (NASA) RF configuration, which requires the PSP.

1: GNC UNIV PTG 3: OFF	2: SM 78 SYS SUMM 4: SM 62 PCMMU/PL COMM

PI SETUP:

MS2 AIL √ S-BD PL CNTL - CMD
√ ANT POLAR - R CIRC
√ XMTR PWR - LO
√ CH SEL INTRG 1,2 tw (six)-089,089
√ MOD - OFF
PWR SYS - 1
√ SEL - BOTH
√ PSP CMD OUTPUT - INTRG
CNTL - PNL

CRT 4: SM 200 IUS/TDRS
√ TDRS RCVR SIG PRES A (*),B (*)

* If TDRS RCVR SIG PRES A (blank), *
* B (blank), then PI FREQ SWEEP - ON *
* for up to 90 sec until TDRS RCVR *
* SIG PRES, then release *

NOTE

Up to 32 sec may be required for an indication of CMD LOCK. TDRS/PI Ops require at least one SIG PRES and one CMD LOCK indication

AIL S-BD PL MOD - ON
√ TDRS RCVR CMD LOCK A (*),B (*)

********** MIL LOS ********** (~ 3:19)

********** ACN AOS ********** (~ 3:31)

3 TDRS (PI) LINK C/O

CRT4 √ TDRS RCVR SIG PRES A (*),B (*)
√ CMD LOCK A (*),B (*)
Advise MCC of TDRS lock status

NOTE

Step 3 is the PI to payload RF link check. Step 4 is a direct check of the NASA payload/Ground Links.

1: GNC UNIV PTG 3: OFF	2: SM 78 SYS SUMM 4: SM 200 IUS/TDRS

NOTE

MCC sends test cmd (2 min)

At MCC GO:
MS2 AIL S-BD PL CNTL - CMD

PI OFF:

AT test completion, MCC will cmd PI off and inform crew

CRT4 √TDRS RCVR SIG PRES A (blank),B (blank)
√CMD LOCK A (blank),B (blank)

********** ACN LOS ********** (~3:38)

*If at LOS, PI not turned *
*off by MCC then: *
* S-BD PL CNTL - CMD *
* PWR SEL - PSP *
* CNTL - PNL, then CMD *

********** GWM AOS ********** (~4:13 ORB 4)

NOTE

During TDRS (DIRECT) Check, A/G COMM is UHF SPLX. Crew XMIT will inhibit RCV

4 TDRS (DIRECT)

NOTE

WSGT sends test cmd (2 min)

********** GWM LOS ********** (~4:22)

3.5 RF CHECKS (LATE): PART I

(Reference Figure 3.2 on page 3-15.)

PURPOSE:

Given the FDF Payload Deploy Checklist (as referenced by the CAP), a crewmember will set-up the PL COMM system to a NASA Payload RF configuration and perform a PI/payload one-way link check (PI to PL RCV).

NOTE

This check involves no payload RF transmission

1: GNC UNIV PTG	2: SM 78 SYS SUMM
3: OFF	4: SM 200 IUS/TDRS

RF CHECKS (LATE): PART I (~ 8:30)

1 TDRS (PI) SETUP

PSP/PDI SETUP:

MS1 CRT I/O RESET PSP 1 - ITEM 6 EXEC (*)
4: SM 62 PCMMU/PL COMM

Verify configuration of PDI

PDI	DECOM	INPUT	FMT
√	1	2	18
√	2	5	17
√	3	0	
√	4	5	14
√	5-FPM		1

PI SETUP:

MS1 AIL √ S-BD PL CNTL - CMD
√ ANT POLAR - R CIRC
√ XMTR PWR - LO
√ CH SEL INTRG 1,23 tw (six)-089,089
MOD - OFF
√ PWR SYS - 1
√ SEL - BOTH
√ PSP CMD OUTPUT - INTRG
CNTL - PNL

CRT 4: SM 200 IUS/TDRS
√TDRS RCVR SIG PRES A (*),B (*)

* If TDRS RCVR SIG PRES A (blank), *
* B (blank), then PI FREQ SWEEP - ON *
* for up to 90 sec until TDRS RCVR *
* SIG PRES, then release *

NOTE

For missions with a CIU this procedure assumes that the CIU payload link switch on panel LIIL is not in the RF position. The RF position deactivates the normal PSP/PI interface and activates the CIU/PI interface.

1: GNC UNIT PTG	2: SM 78 SYS SUMM
3: OFF	4: SM 200 IUS/TDRS

MS1 AIL S-BD PL MOD - ON
CRT4 √TDRS RCVR CMD LOCK A (*),B (*)

NOTE

Up to 32 sec may be required for an indication of CMD LOCK. TDRS/PI OPS require at least one SIG PRES ond one CMD LOCK indication

********** IOS AOS ********** (~8:37)

2 TDRS (PI) LINK C/O

√TDRS RCVR SIG PRES A (*),B (*)
√CMD LOCK A (*),B (*)

Advise MCC of TDRS lock status

NOTE

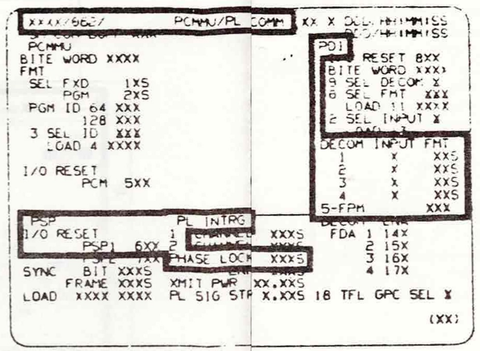
MCC sends test cmd (2 min)

√SM ALERT 200 TDRS XMIT - Ignore msgs

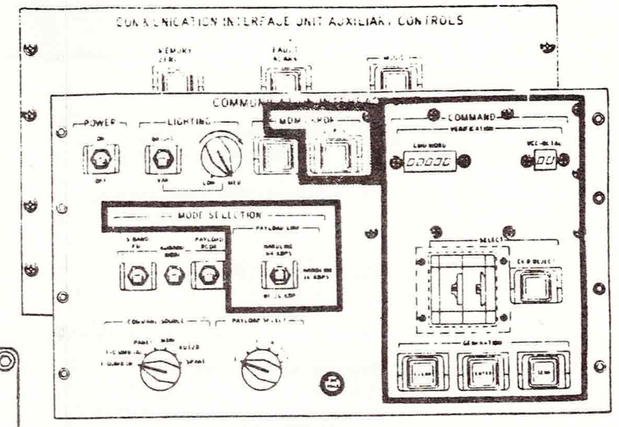
*If MCC advises cmd was *
* unsuccessful, then at LOS: *
* SEND CIU CMD 23, 19101 *
* √CMD WORD ind - X *
* 0 - No CMD from PDU A or B *
* 1 - CMD from PDU A only *
* 2 - CMD from PDU B only *
* 3 - CMD from PDU A & B *

At MCC GO:
AIL S-BD PL CNTL - CMD

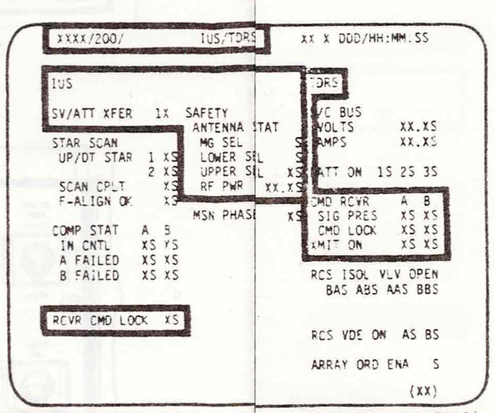
MCC cmds PI - OFF



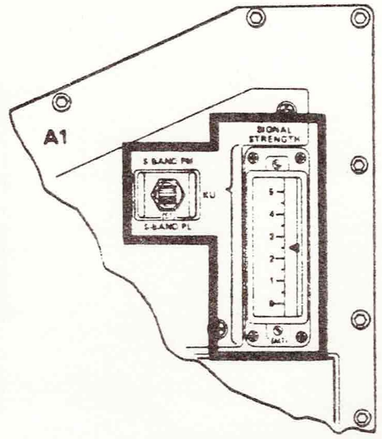
CRT - S62 PCMMU/PL COMM



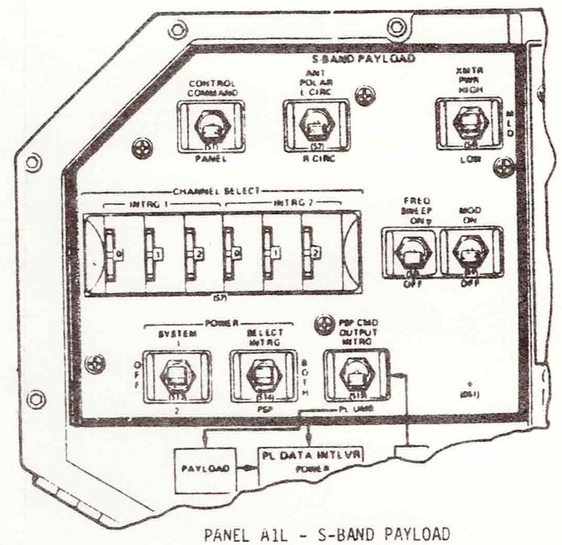
PANEL L11 - COMM INTERFACE UNIT



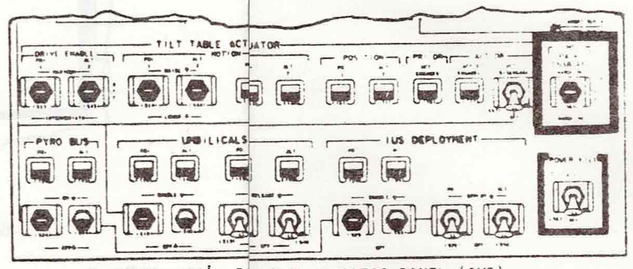
CRT - PAYLOAD SPECIFIC SPEC (SPEC 200 IUS/TDRS)



PANEL A1U - SIGNAL STRENGTH METER



PANEL A1L - S-BAND PAYLOAD



PANEL L10 - PAYLOAD SPECIFIC PANEL (IUS)

Figure 3-2. Displays and Panels

The following Communication Interface Unit (CIU) procedures are only found in payload deploy checklists for DOD payloads requiring Orbiter interface. In these procedures the CIU replaces the PSP for both hardline and RF communications.

The following Communication Interface Unit (CIU) procedures are only found in payload deploy checklists for DOD payloads requiring Orbiter interface. In these procedures the CIU replaces the PSP for both hardline and RF communications.

3.6 COMMUNICATION INTERFACE UNIT COMMAND ENTRY PROCEDURE

(For sections 3.6 - 3.7 reference Figure 3-3 on page 3-20.)

PURPOSE:

Given the FDF Payload Deploy Checklist, a crewmember will perform command transmission from the Orbiter to a DOD payload.

NOTE

This procedure is used throughout the Payload Deploy Checklist for missions requiring the crew to command to a DOD payload.

CIU ENTRY

	CIU COMMAND ENTRY	
L11	√VCC-OCTAL ind	CL
	CMD SEL tn (two)	XX
	GEN ENTER pb	ENTER
	√CMD WORD ind	XXXXX
	GEN SEND pb	SEND
	√CMD WORD ind	BLANK or CMD feedback
	√VCC-OCT ind	XX

NOTE

ENTER places the thumbwheel-selected commands into the CIU transmission buffer. The contents of this buffer are displayed on the CMD WORD indicator. SEND transmits the command to the payload. Use of the command generation area requires the COMMAND SOURCE switch be placed to the PANEL position.

3.7 COMMUNICATION INTERFACE UNIT ACTIVATION AND CHECKOUT PROCEDURE

PURPOSE:

Given the FDF Payload Deploy Checklist, a crewmember will configure the CIU and verify its operational state.

CIU ACTIVATION

L11U √ MODE - CLEAR

√ PWR - STBY

L11L √ PWR - ON

√ DNLK (three) - TLM

√ PL LK - HDLN 64 KBPS

CMD SOURCE - PNL

√ PL SEL - 1

√ No ind light

√ VCC-OCTAL ind - CL

CMD SEL tw (two) - 01

GEN ENTER pb -ENTER

√ CMD WORD ind 30000

NOTE

An OCTAL COMMAND CODE 01 entry results in the display of the payload safety status parameter which has been held in an internal CIU TLM buffer for crew preview. A SEND is not implemented. The safety status display refers to the payload selected (1).

CIU CHECKOUT

L11	CMD SEL tw (two)	-	00
	GEN ENTER pb	-	ENTER
	√CMD WORD ind	-	88888
	√VCC-OCTAL ind	-	88

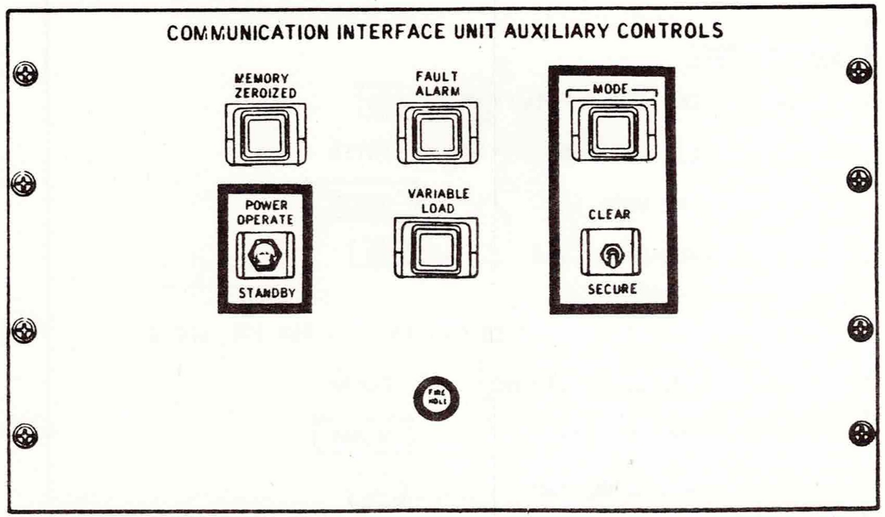
√ALL ind lights on CIU and CIU AUX PNL are on

	√CMD GEN CLEAR pb	-	CLEAR
	CMD WORD ind	-	BLANK
	√VCC-OCTAL ind	-	CL

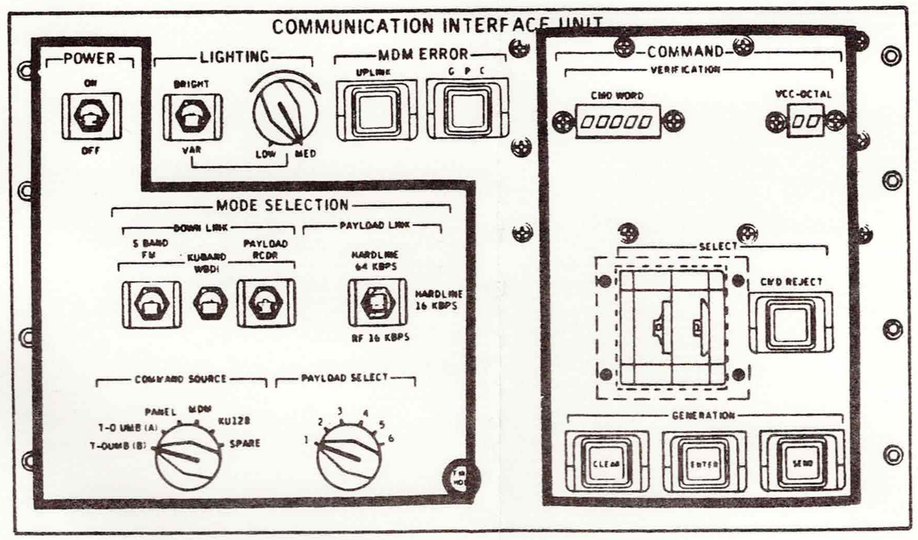
√All ind lights on CIU and CIU AUX PNL are off

NOTE

The OCTAL command code 00 is an internal CIU test. NO SEND is required.



PANEL L11U - CIU AUXILIARY CONTROLS



PANEL L11L - COMMUNICATION INTERFACE UNIT

Figure 3-3. Communication Interface Unit

3.8 TRANSFER PAYLOAD (IUS) TLM RATE CUE CARD PROCEDURE

(For sections 3.8 - 3.11 reference Figure 3-4 on page 3-30.)

PURPOSE:

Given the FDF transfer Payload (IUS) TLM rate cue card, a crewmember will perform a payload telemetry rate change.

TOP

XFER 64 - 16

TRANSFER PL TLM (IUS) RATE TO 16 KBPS HDLN(RF)

MS2	CRT4	SM 62 PCMMU/PL COMM DECOM 4 FDA ITEM 17 EXEC (blank)
	L10	CMD PATH ENA - HDLN (RF is PI LINK)
	L11	MODE SEL PL LK - HDLN 16 KBPS (RF 16 KBPS if PI LINK)
		√ VCC-OCTAL ind - nL Send CIU CMD 37, 12H11 No CIU CMD feedback √ VCC-OCTAL ind - CL
	CRT4	DECOM 2 FDA ITEM 15 EXEC (*)

XFER 16 - 64

TRANSFER PL (IUS) TLM RATE TO 64 KBPS

MS2	CRT4	SM 62 PCMMU/PL COMM DECOM 2 FDA ITEM 15 EXEC (blank)
	L10	CMD PATH ENA - HDLN
	L11	MODE SEL PL LK - HDLN 64 KBPS
		√ VCC-OCTAL ind - nL Send CIU CMD 40, 12211 No CIU CMD feedback √ VCC-OCTAL ind - CL
	CRT4	DECOM 4 FDA ITEM 17 EXEC (*)

NOTE

The PDI DECOM FDA is driven by the DECOM sync status. A telemetry rate change will set-off the FDA unless it is first disabled. After the TLM rate change is made, the PDI DECOM FDA for the DECOM with the format compatible with new rate is ENABLE.

3.9 RF CHECKS (LATE): PART II

PURPOSE:

Given the FDF Payload Deploy Checklist (as referenced by the CAP), a crewmember will assist with direct (ground to payload) payload RF checks, will set-up the PL COMM system to a DOD payload RF configuration, and will perform a PI/payload two-way link check.

NOTE

These checks involve payload RF transmission.

1: GNC UNIT PTG	2: SM 78 SYS SUMM
3: OFF	4: SM 200 IUS/TDRS

RF CHECKS (LATE) PART II (~ 9:02 ORB 7)

1 IUS (DIRECT)

MS1 L12 IUS RF ANT E/D - ENA
√ENA tb - gray
√DSBL tb - bp

L10 √CMD PATH ENA - HDLN
L11 √IUS TLM rate HDLN 64 KBPS

CRT4 √IUS SAFETY RF PWR - 25.0 ± 5.0

L10 CMD PATH ENA - RF

-00:58 ********** GTS AOS ********** (~ 9:05)

AFSCF sends cmds

A6, F7 Start EVENT TIMERS counting DN to DEPLOY

-00:54 ********** GTS LOS ********** (~ 9:07)

L10 CMD PATH ENA -HDLN

1: GNC UNIT PTG 3: OFF	2: SM 78 SYS SUMM 4: SM 200 IUS/TDRS

2 IUS (PI) LOCK (~9:07)

MS1 L11 √ IUS TLM rate HDLN 16 KBPS

PDI SETUP:

CRT 4: SM 62 PCMMU/PL COMM

Verify configuration of PDI

PDI	DECOM	INPUT	FMT
√	1	2	18
√	2	5	17
√	3	0	
√	4	5	14
√	5-FPM		1

PI SETUP:

AIL √ S-BD PL CNTL - CMD
√ ANT POLAR - R CIRC
√ XMTR PWR - LO
√ CH SEL INTRG 1,2 tw (six)-906,906
MOD - OFF
√ PWR SYS - 1
√ SEL - BOTH
√ PSP CMD OUTPUT - INTRG
CNTL - PNL

A1U SIG STRENGTH sel - S-BD PL
Verify S/S ≥ TBS volts

CRT4 √ PL INTRG PHASE LOCK - YES

1: GNC UNIT PTG 3: OFF	2: SM 78 SYS SUMM 4: SM 62 PCMMU/PL COMM

MS1 CRT 4: SM 200 IUS/TDRS
IUS RCVR CMD LOCK (*)

* If IUS RCVR not locked, then PI *
* FREQ SWEEP - ON for up to 35 sec *
* until RCVR CMD LOCK indicated, *
* then release *

A1L S-BD PL MOD - ON
L11 MODE SEL PL LK - RF 16 KBPS
VCC-OCTAL ind - CL

NOTE

Crew may receive ERR MSG - 'S62 PDI DECOM FAIL' as result of this switch action. Ignore message

3 TDRS (DIRECT)

-00:46 ********** HAW AOS ********** (~ 9:15)

NOTE

During TDRS (DIRECT) Check, A/G COMM is UHF SPLX. Crew XMIT will inhibit RCV

CRT4 Crew advises MCC of IUS/PI lock status
IUS RCVR CMD LOCK (*)

NOTE

WSGT sends test cmd (2 min)

MCC updates Deploy Pad & Sep Burn Pad
MCC gives TDRS direct check status

1: GNC UNIV PTG	2: SM 78 SYS SUMM
3: OFF	4: SM 200 IUS/TDRS

* If TDRS DIRECT Check is not successful, per MCC instruction mnvr per 9D AGO ATT pad and repeat TDRS DIRECT Check. The earliest deploy will be 9D. There is no uplink voice at AGO until TDRS DIRECT Check is completed
*
* MNVR OPTION:
* R _ _ _. _ _ _ _ . _
* P _ _ _. _ _ _ _ . _
* Y _ _ _. _ _ _ _ . _
*
* DAP: A/AUTO/VERN ··
* (HAW LOS) Initiate MNVR

MCC gives GO for DEPLOY

NOTE

If no comm at HAW, mnvr to DEPLOY ATT per CAP.

-00:36 ********** HAW LOS ********** (~9:20)

3.10 PAYLOAD DEPLOY COUNTDOWN COMM VERIFICATION

PURPOSE:

Given the FDF Payload Deploy Checklist, a crewmember will correctly verify that the PI and payload are locked to each other's RF transmissions prior to umbilical release.

1: GNC UNIT PTG	2: SM 78 SYS SUMM
3: OFF	4: SM 200 IUS/TDRS

DEPLOY COUNTDOWN (~10:00 ORB 7)

MS2 A7 VTR RCD - A
MON 1 (2) - A; Zoom, align and focus to view Umbilical release

1 PI LOCKED TO IUS

CRT4 √IUS RCVR CMD LOCK (*)

4: SM 62 PCMMU/PL COMM
√PL INTRG PHASE LOCK - YES

2 CYCLIC XFER OF SV TO CIU

CRT 4: SM 200 IUS/TDRS
IUS SV/ATT XFER - ITEM 1 EXEC (*)

L11 √MDM ERR GPC lt - off

PLT/F7/ MS2 A4 √EVENT TIMER - Counting DN to DEPLOY

PLT √CRT EVENT TIMER - Counting DN to DEPLOY

MS1 L10 CMD PATH ENA - RF

MS2 CRT4 √IUS COMP STAT A B
IN CONTROL *
√A FAILED (blank)
√B FAILED (blank)

CAUTION

Notify MCC of other indications. Do not deploy IUS until it is determined a healthy avionics string exists

1: GNC UNIT PTG	2: SM 78 SYS SUMM
3: OFF	4: SM 200 IUS/TDRS

5 DEADFACE UMBILICALS

MS1 L10
IUS HTRS BATT PRI(ALT) - OFF (mom)
√PRI,ALT (two) tb - bp
PWR PRI(ALT) - OFF (mom)
√PRI,ALT (two) tb - bp
S/C REG PWR PRI(ALT) - OFF(GSE) (mom)
√PRI,ALT (two) tb - bp

MS2 R11
VTR pb - PLAY, RCD (simo)
√STBY - RUN

Take Spotmeter reading of TDRS
Set 16mm and 70mm Camr lenses

CAUTION

Prior to Umbilical rel,
CRT4
√For change in IUS COMP STAT since given GO for DEPLOY
IUS RCVR CMD LOCK (*)
TDRS XMIT ON A (*) or B (*)
L10
√IUS BUS A,B BATT PRI,ALT (four) tb - gray
√IUS S/C BATT PRI,ALT (two) tb - gray
CMD PATH ENA - RF
L12
√IUS RF ANT ENA tb - gray

If change in IUS COMP STATUS and/or above indications cannot be confirmed, refer to 'IUS GO/NO GO CHART' Cue Card

MS1 L12
cb SW PWR - op
cb IUS ANT TB PWR - op

MS2
16mm Camr - on

3.11 PL INTRG REACQ PROCEDURE

PURPOSE:

Given the FDF Orbit Operations Checklist, a crewmember will reestablish two-way lock between the PI and the Payload Transponder.

PL INTRG REACQ

1 Using COAS/out-of-window visual, verify payload is within approx ±60° of -Z

2 VERIFY NOMINAL CONFIG

A1L
- √ S-BD PL CNTL - CMD
  - √ XMTR PWR - (as reqd by CAP or PL DEPLOY C/L)
  - √ CH SEL INTRG 1,2 tw (six) - 089,089 (TDRS)
    - 906,906 (IUS)
  - √ FREQ SWEEP - OFF
  - √ MOD - ON
  - √ PWR SYS - 1
  - √ PWR SEL - BOTH
  - √ PSP CMD OUTPUT - INTRG
- √ PL DATA INTLVR PWR - ON

A1U
- √ SIG STRENGTH sel - S-BD PL

3 CYCLE PI PWR

A1L
- S-BD PL MOD - OFF
  - PWR SEL - PSP
  - CNTL - PNL, then CMD
- Wait 5 seconds, then;
  - S-BD PL PWR SEL - BOTH
  - CNTL - PNL

SM 62 PCMMU/PL COMM

NOTE

Step 1 - This step verifies that the payload is within the beam of the payload antenna. Step 3 is a workaround for PSP design anomalies.

4 CHECK PL SIG STRENGTH

CRT If PL SIG STR < 1.43 or PHASE LOCK = NO:
| If SYSTEM RECONFIG previously done,
| consult MCC>>
A1L | S-BD PL CNTL - CMD
or PWR SYS - 2
| CNTL - PNL
CRT | ERR MSG - 'S62 BCE BYP PSP1'
| PSP I/O RESET PSP2 - ITEM 7 EXEC (*)
| Repeat step 4
If PL SIG STR > 1.43 and PHASE LOCK = YES,
config CMD LINK
4: PL SPEC XXX
√PL RCVR LOCK - *

* If PL RCVR not LOCKED: *
* A1L FREQ SWEEP - ON for up to 90 secs *
* until LOCK, then OFF *

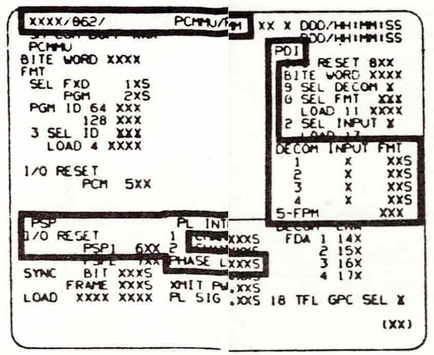
NOTE

Step 5 not reqd for IUS

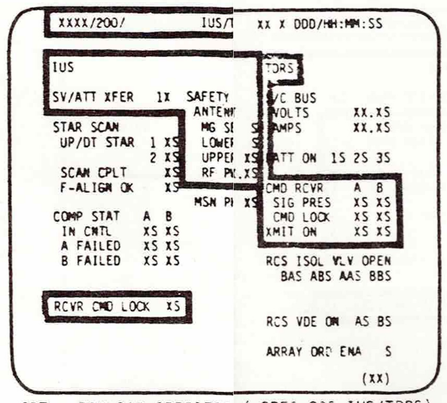
CRT 5 Config PSP via PL SPEC ITEM ENTRY (if available) or wait for MCC

A1L 6 √ S-BD PL FREQ SWEEP - OFF
MOD - ON

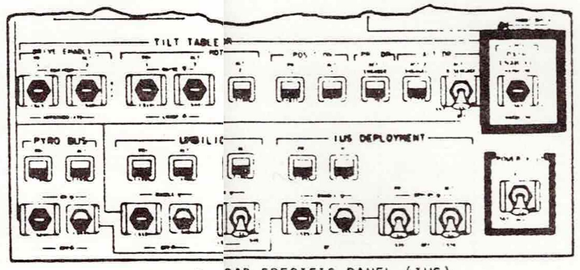
7 S-BD PL CNTL -CMD



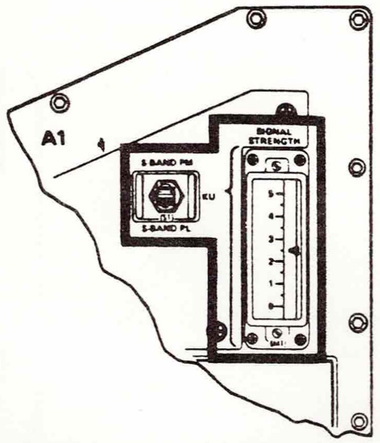
CRT - S62 I/PL COMM



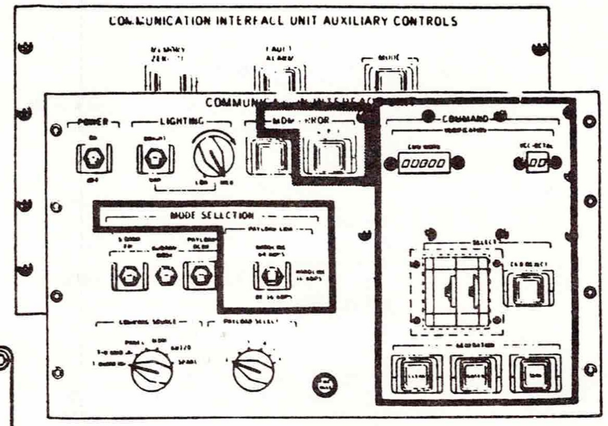
CRT - PAYLOAD SPECIFIC (SPEC 200 IUS/TDRS)



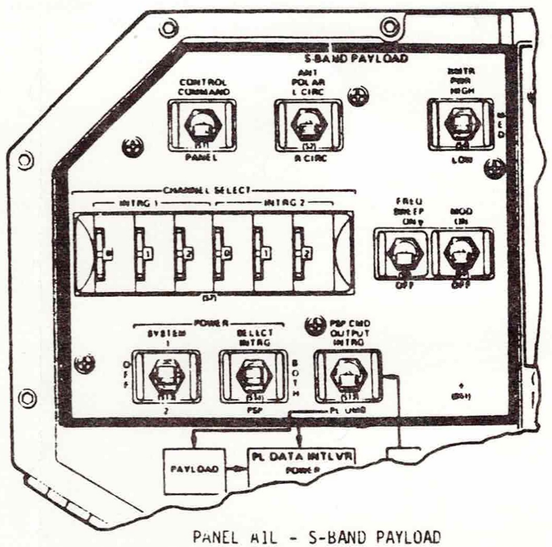
PANEL L10 -OAD SPECIFIC PANEL (IUS)



PANEL A1U - SIGNAL STRENGTH METER



PANEL L11 - COMM INTERFACE UNIT



PANEL A1L - S-BAND PAYLOAD

Figure 3-4. Displays and Panels

APPENDIX A

ACRONYMS AND ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS

A/D	Analog-to-Digital
BCE	Bus Control Element
BFS	Backup Flight System
BOT	Beginning of Tape
CC	Cargo Control
CIU	Communication Interface Unit
DPS	Data Processing System
DSN	Deep Space Network
EOT	End of Tape
FDA	Fault Detection and Annunciation
FMDM	Flexible Multiplexer/Demultiplexer
FPM/TBI	Fetch Pointer Memory/Toggle-Buffer Indicator
GCIL	Ground Control Interface Logic
GFE	Government Furnished Equipment
GN&C	Guidance, Navigation, & Control
GPC	General Purpose Computer
GSE	Ground Support Equipment
HDR/LDR	High Data Rate/Low Data Rate
I/O DB	Input/Output Data Bus
I/OM	Input/Output Module
I/OP	Input/Output Processor
IUS	Inertial Upper Stage
KGT/R	KG Transmitter and Receiver
LRU	Line Replaceable Unit
MCDS	Multifunction CRT Display System
MDM	Multiplexer/Demultiplexer
MIA	Multiplexer Interface Adapter
MULT	Multiple
NSP	Network Signal Prcessor
OFT	Orbital Flight Test
OI	Operational Instrumentation
PCMMU	Pulse Code Modulation Master Unit
PCS	Payload Control Supervisor

PDI	Payload Data Interleaver
PI	Payload Interrogator
PL COMM	Payload Communication
PL RCDR	Payload Recorder
PROM	Programmable Read Only Memory
PSK	Phase Shift Keyed
PSP	Payload Signal Processor
RAM	Random Access Memory
RTC	Real Time Command
SCU	Sequency Control Unit
SGLS	Space Ground Link System
STBY	Standby
STDN	Spaceflight Tracking and Data Network
TB	Toggle Buffer
TEC	Time Executed Command
UL	Uplink
WBDI	Wide Band Data Interleaver

MAIL TO: DG4/J. W. Mapp

LESSON CRITIQUE SHEET

LESSON CODE P/L COM 2102 DATE OF MATERIAL 4/01/83

Please explain any negative answers to the questions below in specific terms. Use the back of the sheet if required.

1. Was the lesson material presented in a logical manner?

2. Comments on handout organization:

3. Were the figures and diagrams optimum to understanding the material?

4. Did the lesson start from your entry level?

5. In your opinion, was the level of detail about right?

6. Additions or deletions from the lesson?

7. Prior knowledge: Considerable _____ Some _____ Very little _____

8. Other comments (or questions):

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25	26	27	28	29	30	31	32	33	34	35	36

PART 2

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37	38	39	40	41

ENTER TIME TO COMPLETE THIS LESSON

	:		
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HR:MIN

DATE COMPLETED (M/D/Y)

		/			/		
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0	4	/	0	1	/	8	3
61	62	63	64	65	66	67	68

I certify that I have completed this lesson.

STUDENT SIGNATURE _____

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